

PTM TRAINING MANUAL

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- | | |
|--------------------------------------|---|
| 1. Operating training | 9. Insulation monitoring device |
| 2. Compressor MS 880 I | 10. Weighing system |
| 3. Pneumatic diagram | 11. Compressor MS 880 I electrical |
| 4. Hydraulic adjustment | 12. Hydraulic electrical adjustment |
| 5. Hydraulic diagram | 13. Compensated brake type 52 electrical |
| 6. Safety brake th9-3 with HU | |
| 7. Compensated brake type 52 | |
| 8. Air conditioning | |



EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MA'ADEN project

P1034

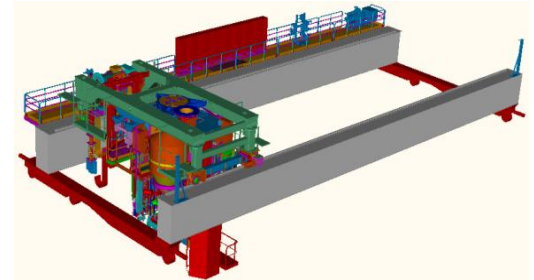
PTA - POT TENDING ASSEMBLY

OPERATING TRAINING

<http://www.ecl.fr>

SUMMARY

1. HEALTH & SAFETY
2. TECHNICAL DATA
3. OPERATION DESCRIPTION
4. EQUIPMENT DESCRIPTION
5. OPERATING MODE
 - From cabin (PTA)
 - From Remote control box (Floor)
6. ALARM & FAULT



HEALTH & SAFETY

Hearing protection is mandatory



Safety glasses



Helmet

Wearing a mask is mandatory



**INDIVIDUAL
PROTECTION
RECOMMENDED by ECL**

Liquid metal



Wear long cuff gloves

Lower your visor



shirt

YES



No



HEALTH & SAFETY Behavior

Floor

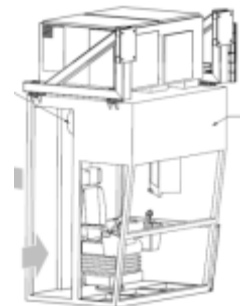
- * Do not travel under the PTM tool trolley (risk of falling objects)
- * Put your individual protections
- * Go away from the danger
- * thermal stresses during the summer season => refer to your supervisor or his/her delegate to take action.



GOOD PRACTICE on SITE DURING THE OPERATIONS

Cabin

- * Always travel between the trays and the pots with the butts and new anodes
- * Use the horn during the moves with the tools
- * Be attentive to the movements of the persons on the ground
- * Use the procedure

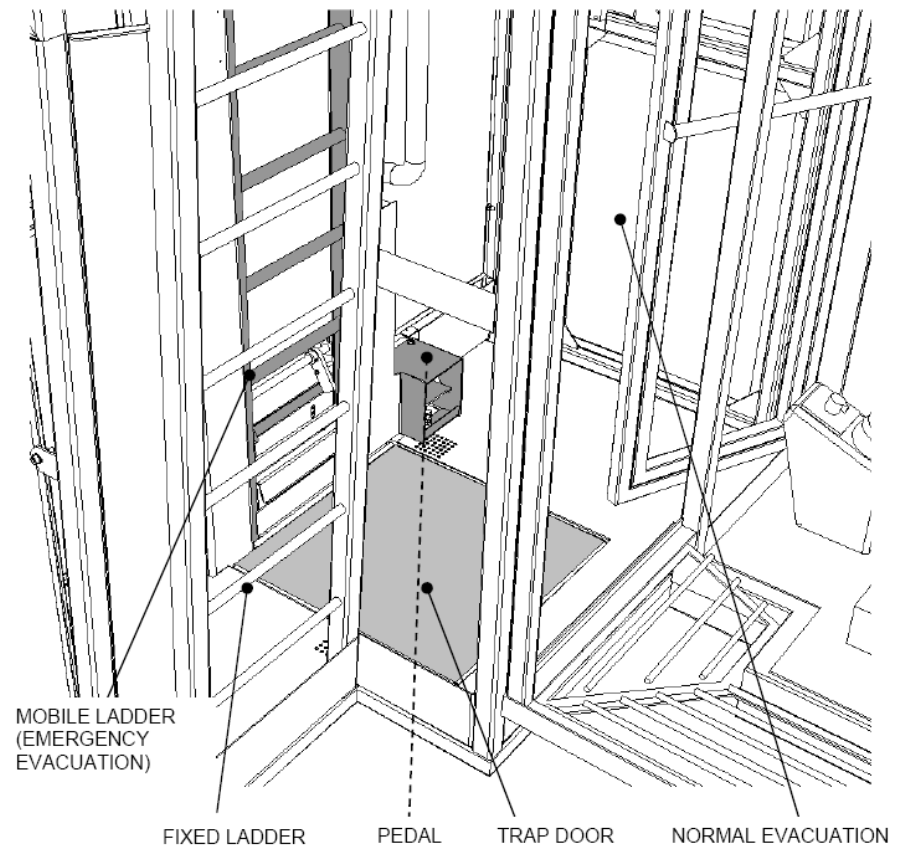
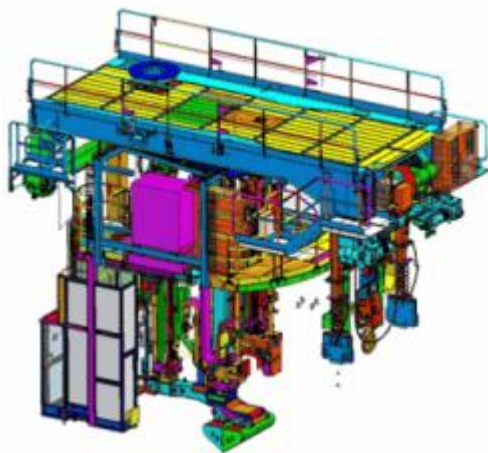


HEALTH & SAFETY

Exit & emergency exit

In case of trouble, the operator can leave the cabin whatever the pot tending machine position in the pot room by using the ladders located on the right of the cab.

He can leave the cabin by the emergency evacuation trap door located on the bottom of the ladder, this trap door can be opened from the right part of the cab and the telescopic ladder can be lowered manually by pushing down the mobile part of the ladder.

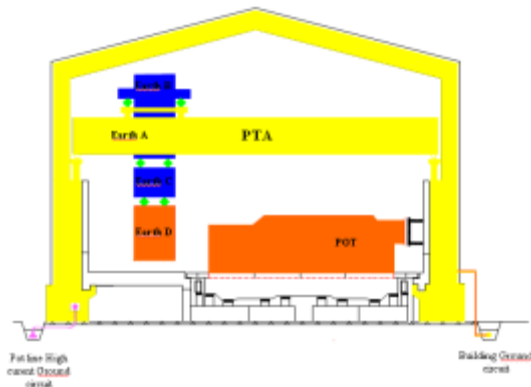


HEALTH & SAFETY

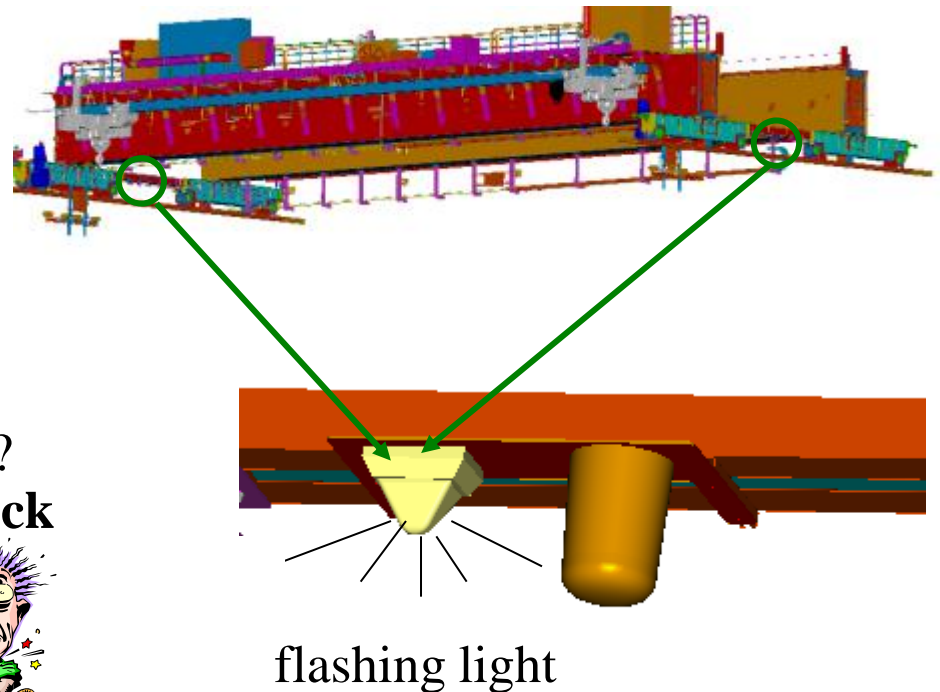
Risk of electrical shock

When you have a problem with INSULATION on the PTA, there are information (alarm or fault) & a flashing light:

1. You must raise all tools in UP position & move crane in safe area
2. You must call the operator of maintenance



Why monitor insulation of the cranes?
Because there are **risk of electrical shock**
for you

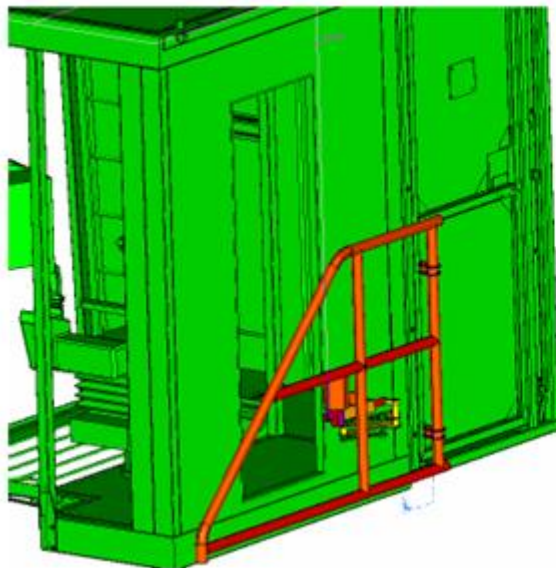


HEALTH & SAFETY

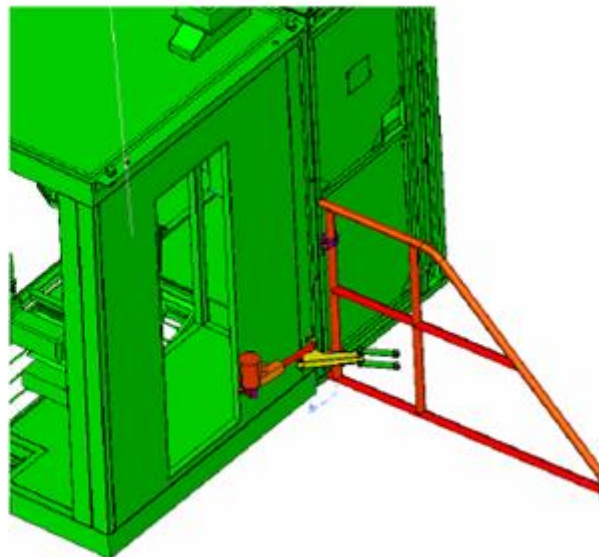
Risk of electrical shock

A removable guard rail is installed on the PTM to secure the junction between the PTM cabin and the walkway

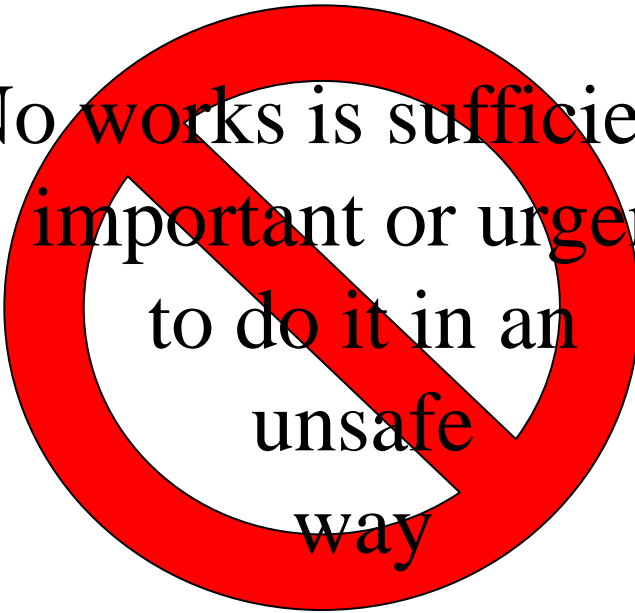
Guard rail retracted



Guard rail extended



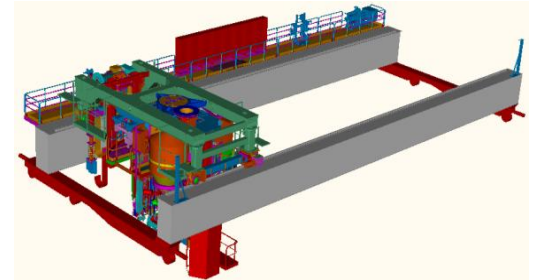
HEALTH & SAFETY



No works is sufficiently
important or urgent
to do it in an
unsafe
way

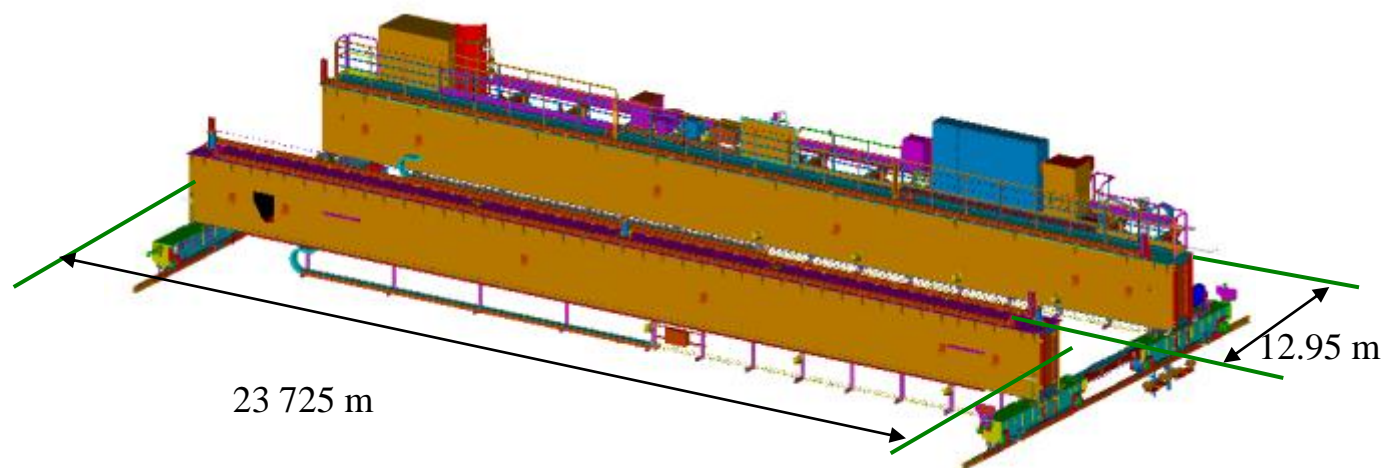
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TECHNICAL DATA

Dimension & weight



Building rail level 5 600 mm

Overall width of the crane 12 950 mm

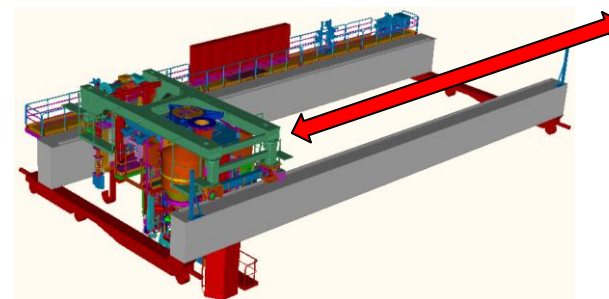
Overall length of the crane 23 725 mm

TECHNICAL DATA

2 to 80 m/min (variable speed)

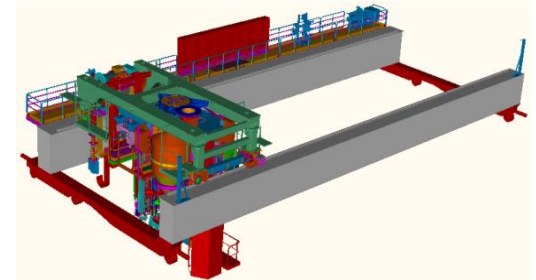


2 to 40 m/mn (variable speed)



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OPERATION DESCRIPTION

Anode changing

- Breaking of the crust bath
- Clamping of the anode
- Lowering of the wrench
- Loosening anode connector
- Retracting the wrench with anode connector
- Removing the butt anode
- Cleaning of the anode hole
- Setting of a new anode on the pot
- Lowering of the wrench
- Tightening of the anode connector
- Retracting of the wrench and the extracting mechanisms
- Feeding of crushed bath on the new anode



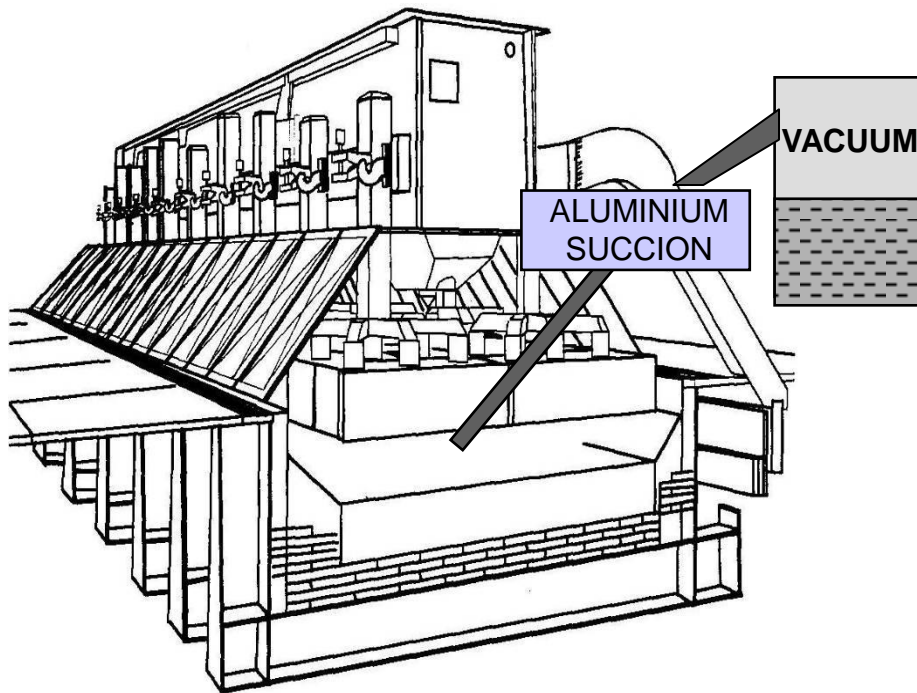
OPERATION DESCRIPTION

METAL TAPPING

Tapping of Metal

Handling of the metal tapping crucible

Control of the metal weight



OPERATION DESCRIPTION

MISCELLANEOUS HANDLING

Handling of the anode raising beam

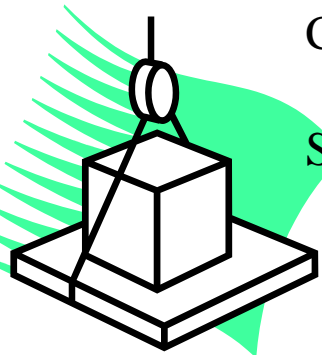
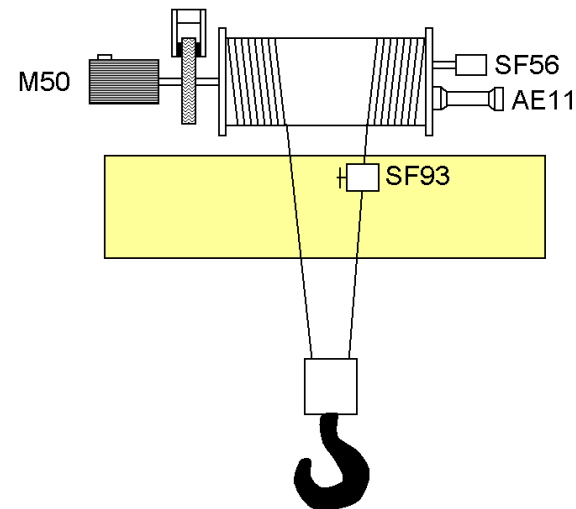
Handling of the anode bracket assembly without stem.

Handling of the fallen anode

Handling of the alumina feeding device

Crushed bath hopper

Shunt resistance

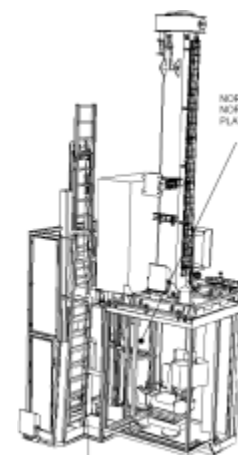


OPERATION DESCRIPTION

MACHINE DRIVING

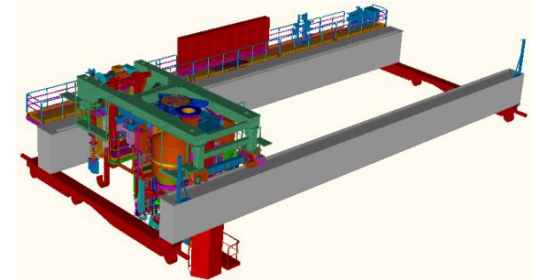


Type of operation	PTM equipment used	Control	
		Cabin	Remote
Anode assembly change	Extracting	X	
Automatic anode assembly gauging	Extracting	X	
Bath crust breaking	Crust breaker	X	X
Anode location cleaning	Shovel	X	
Anode covering	Bath pipe	X	X
Loading of PTM hopper with anode cover material		X	X
Tapping hole opening	Crust breaker	X	X
Aluminium tapping	Main Hoist		X
Closing tapping hole	Bath pipe		X
Pot hopper ALF3 filling	Main Hoist	X	X
Anode beam raising frame	Main Hoist		X

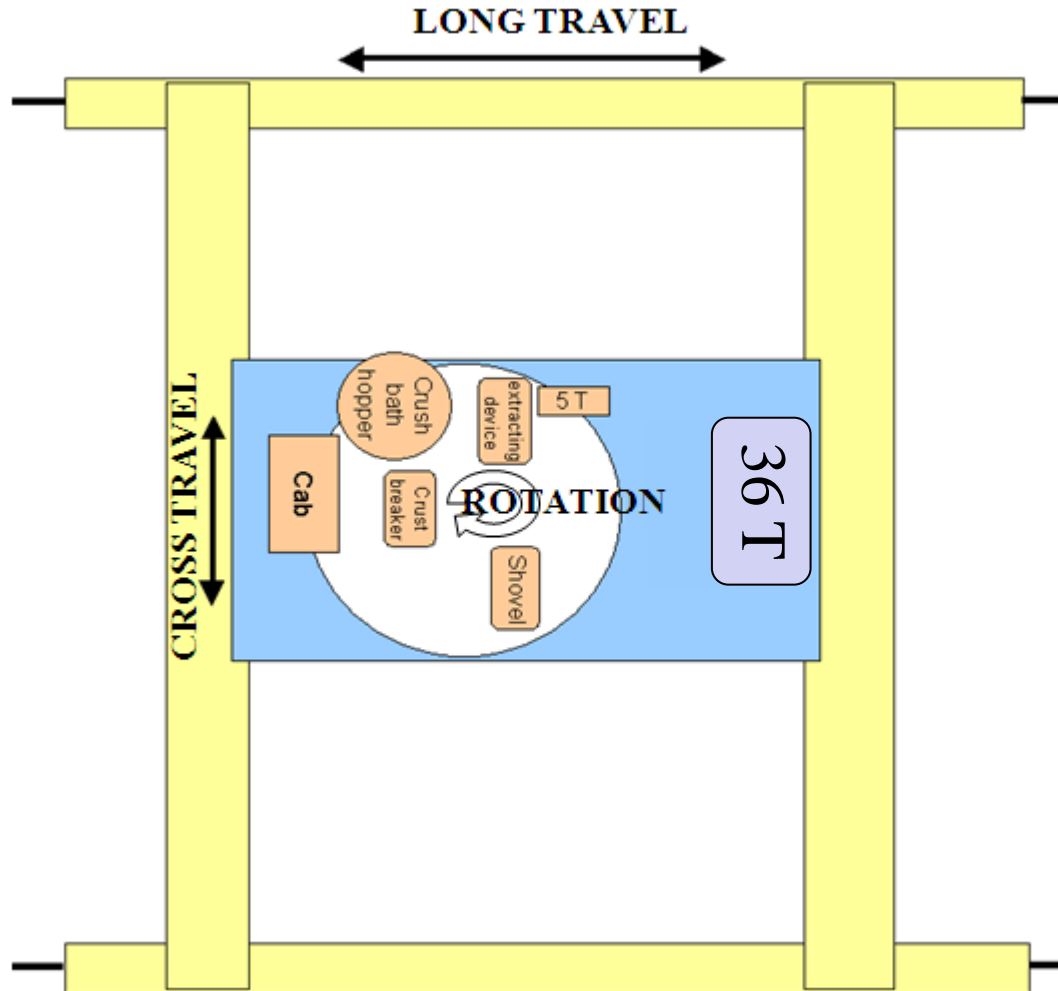


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EQUIPMENT DESCRIPTION



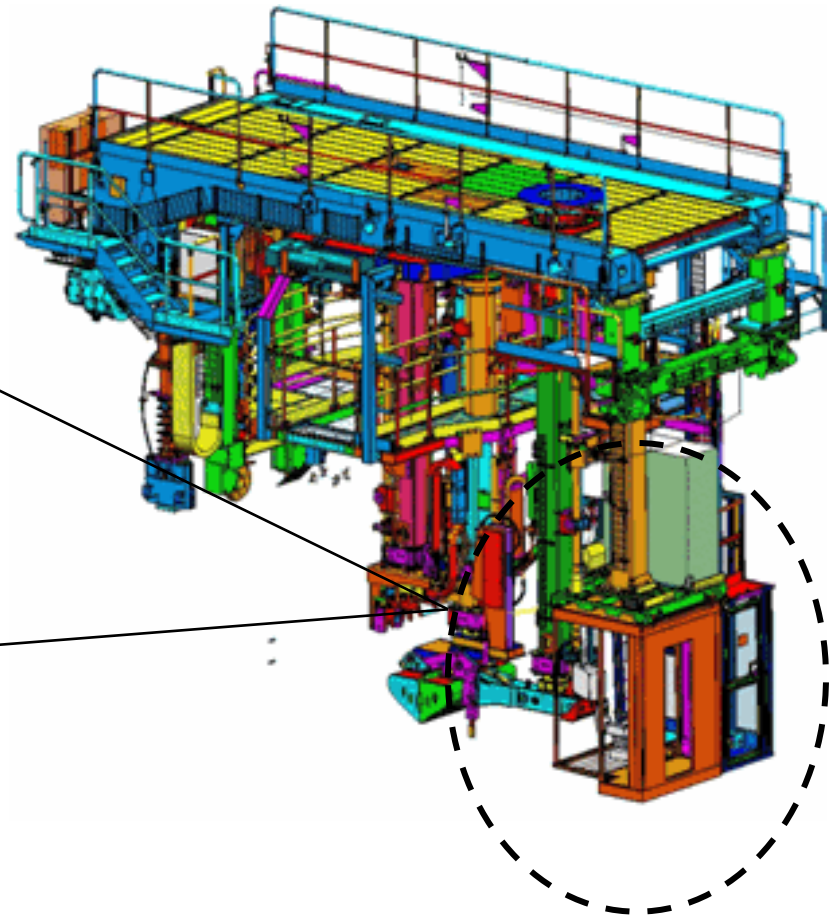
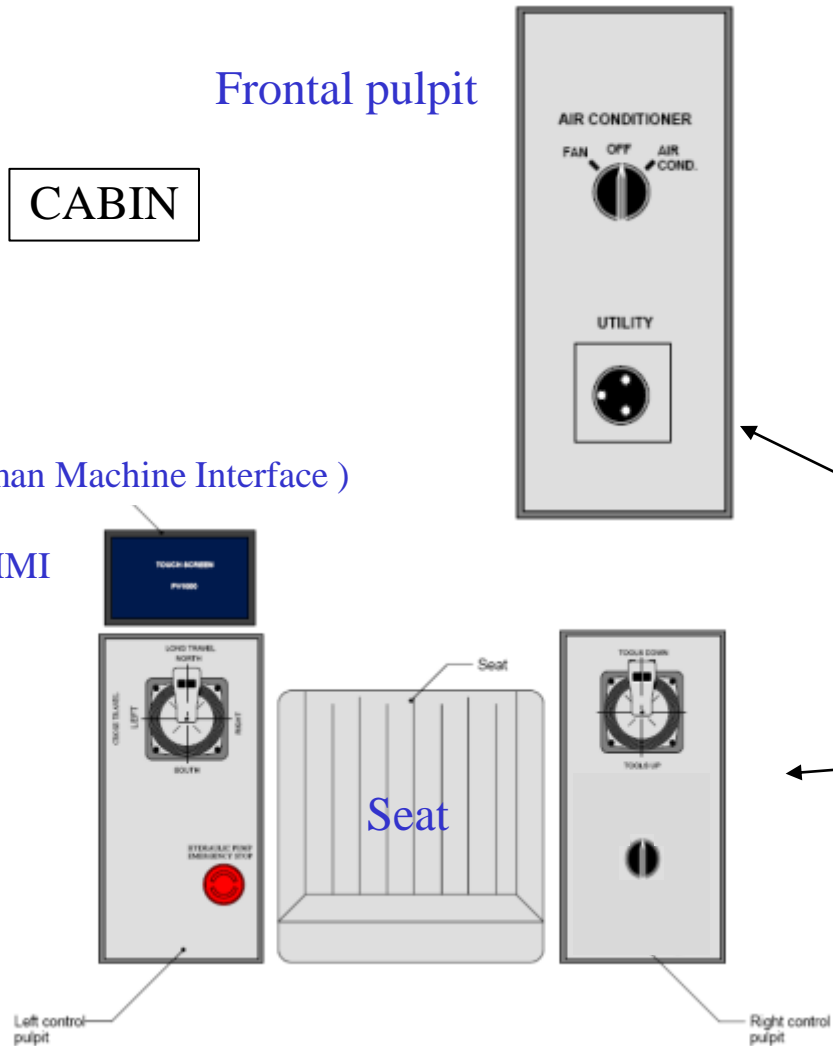
EQUIPMENT DESCRIPTION

Frontal pulpit

CABIN

(Human Machine Interface)

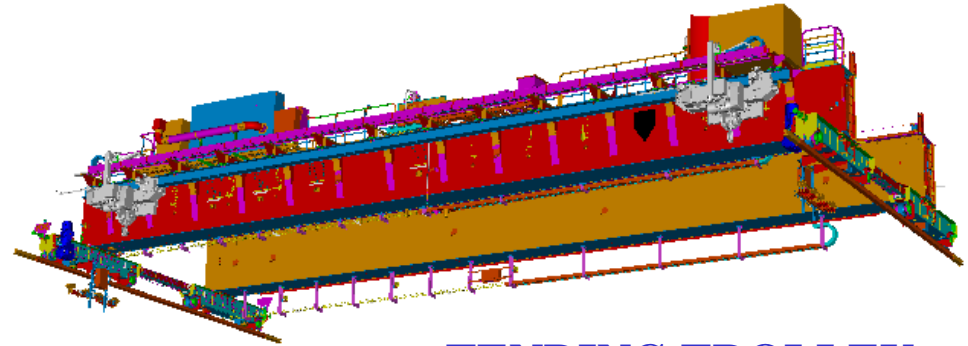
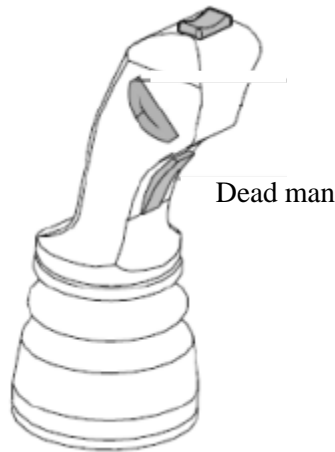
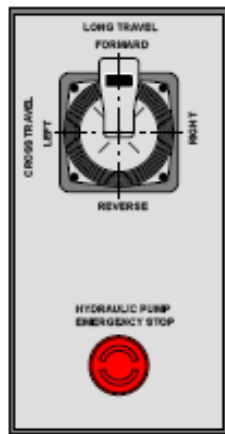
HMI



EQUIPMENT DESCRIPTION

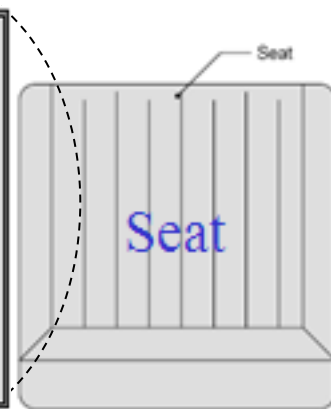
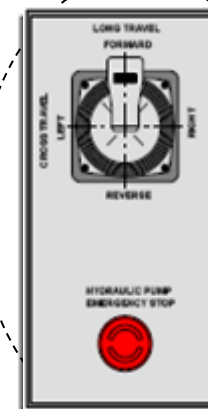
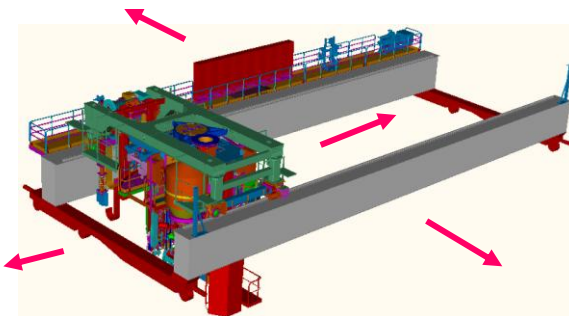
Cabin – Left control pulpit

Figure 3 : Left control pulpit



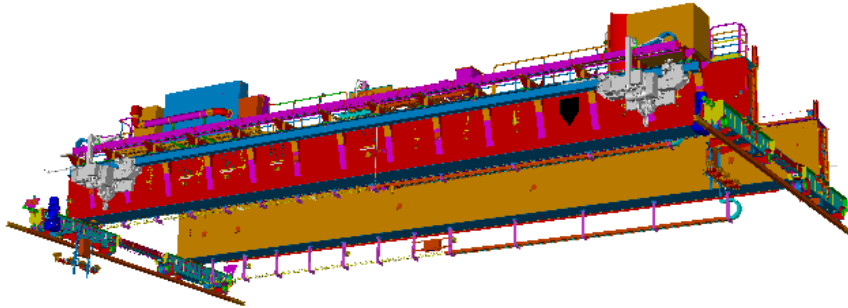
TENDING TROLLEY

LONG TRAVEL CROSS TRAVEL



EQUIPMENT DESCRIPTION

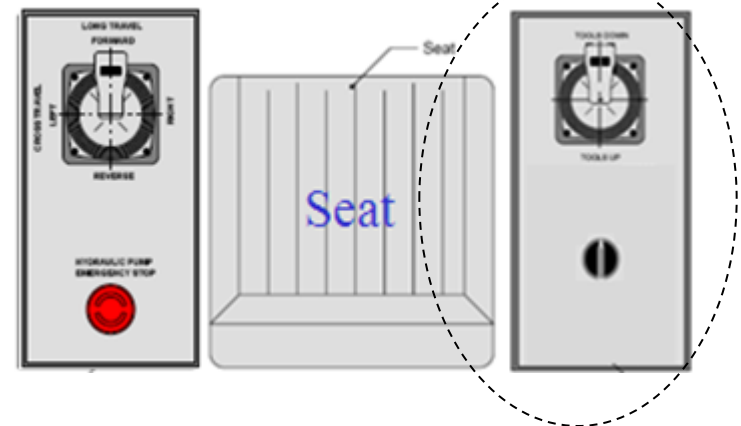
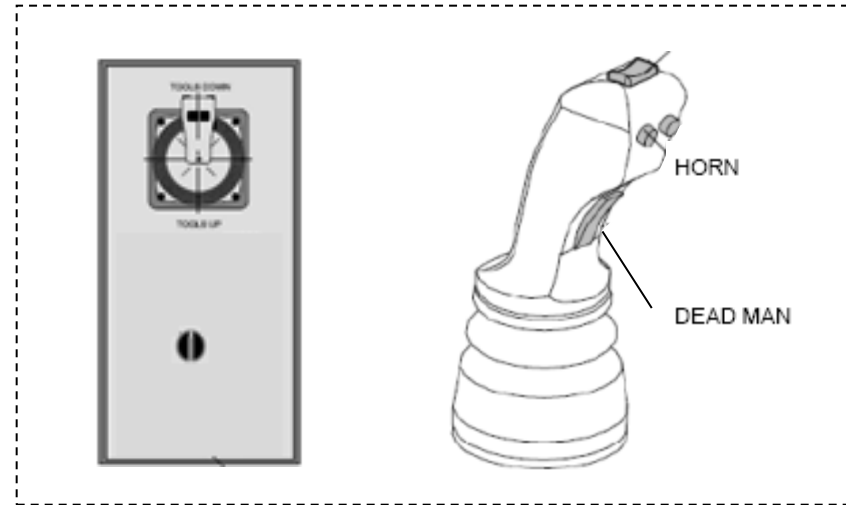
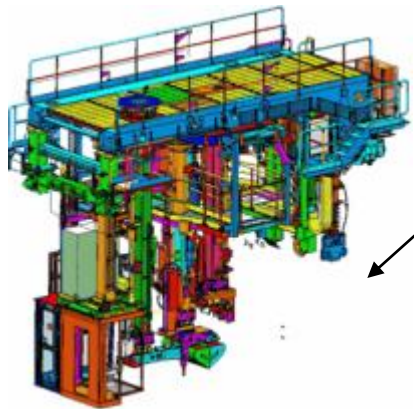
Cabin – Right control pulpit



TENDING TROLLEY

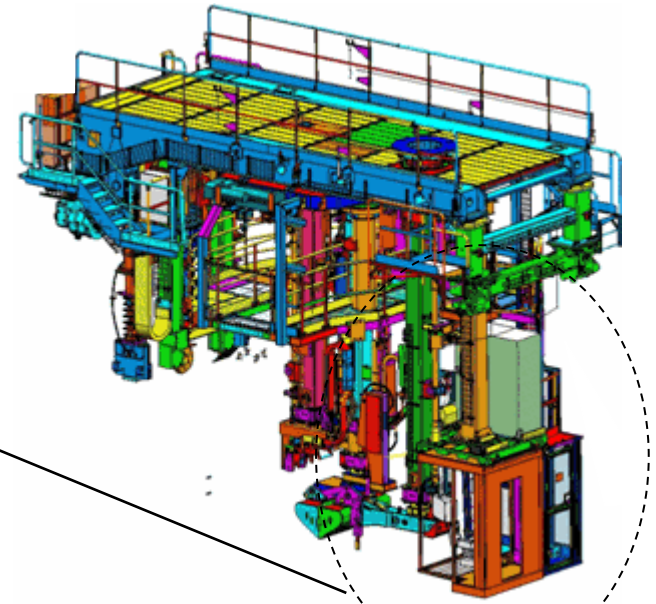
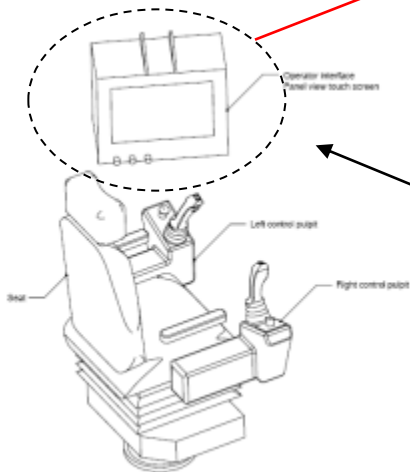
HORN

MANAGEMENT of TOOLS



EQUIPMENT DESCRIPTION

Cabin – Interface operator

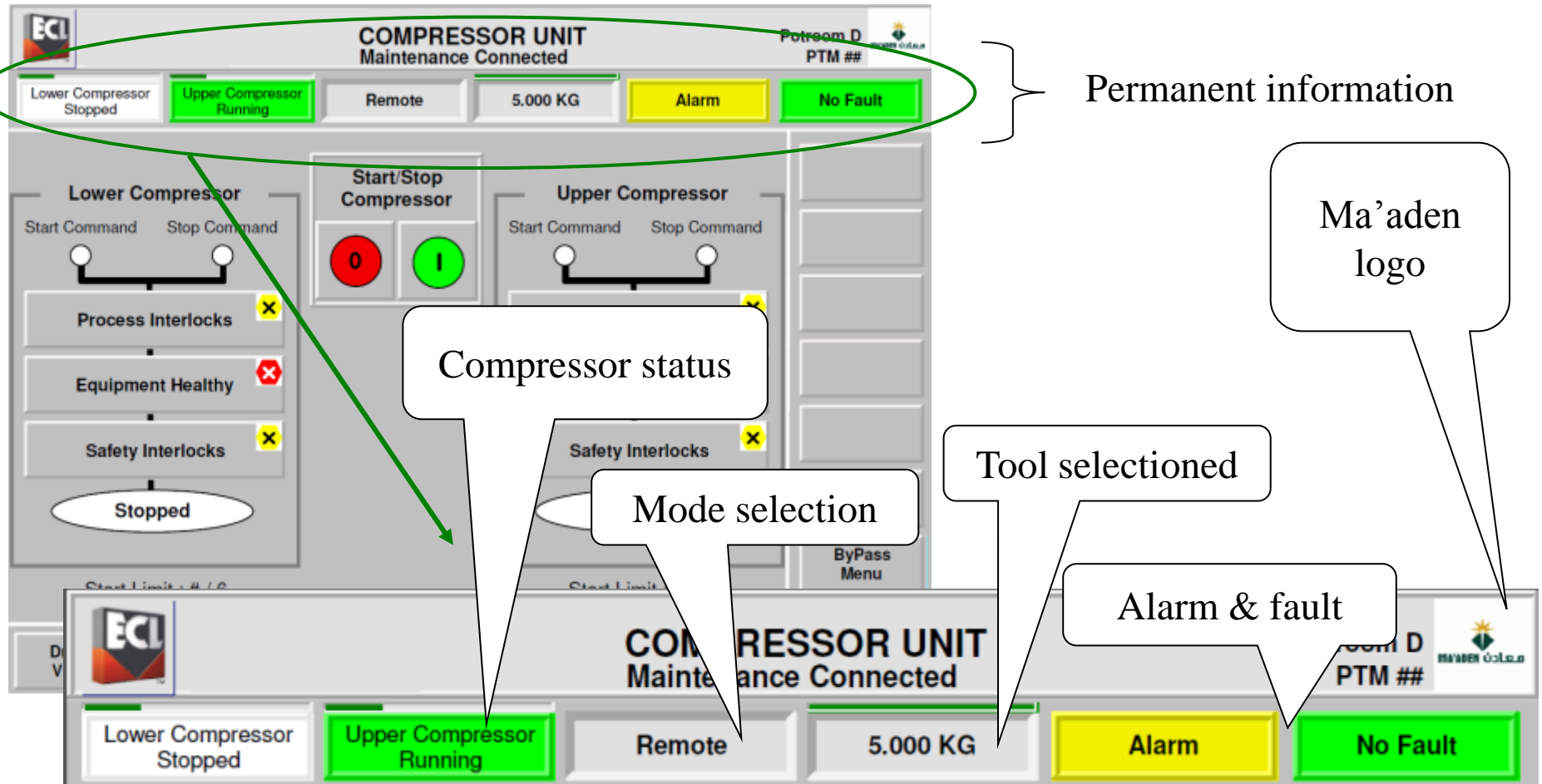


HMI : Human Machine Interface

EQUIPMENT DESCRIPTION

Operator Interface

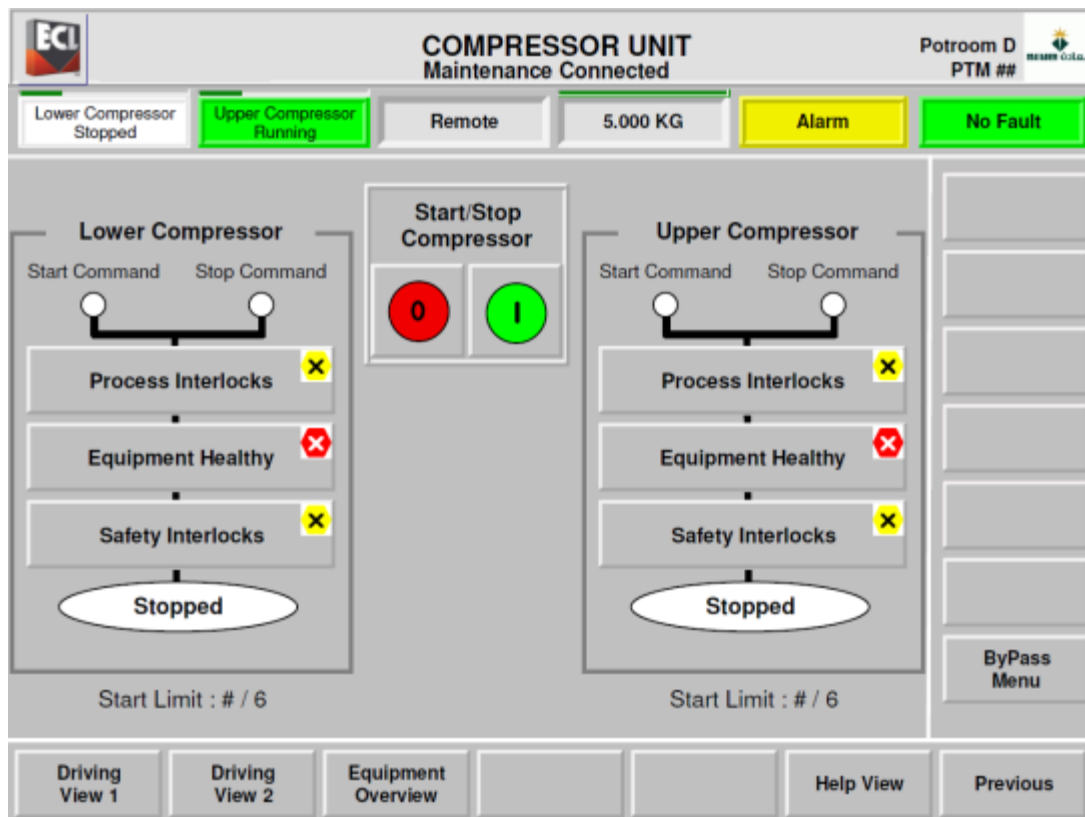
Views => 2 parts



EQUIPMENT DESCRIPTION

Operator Interface

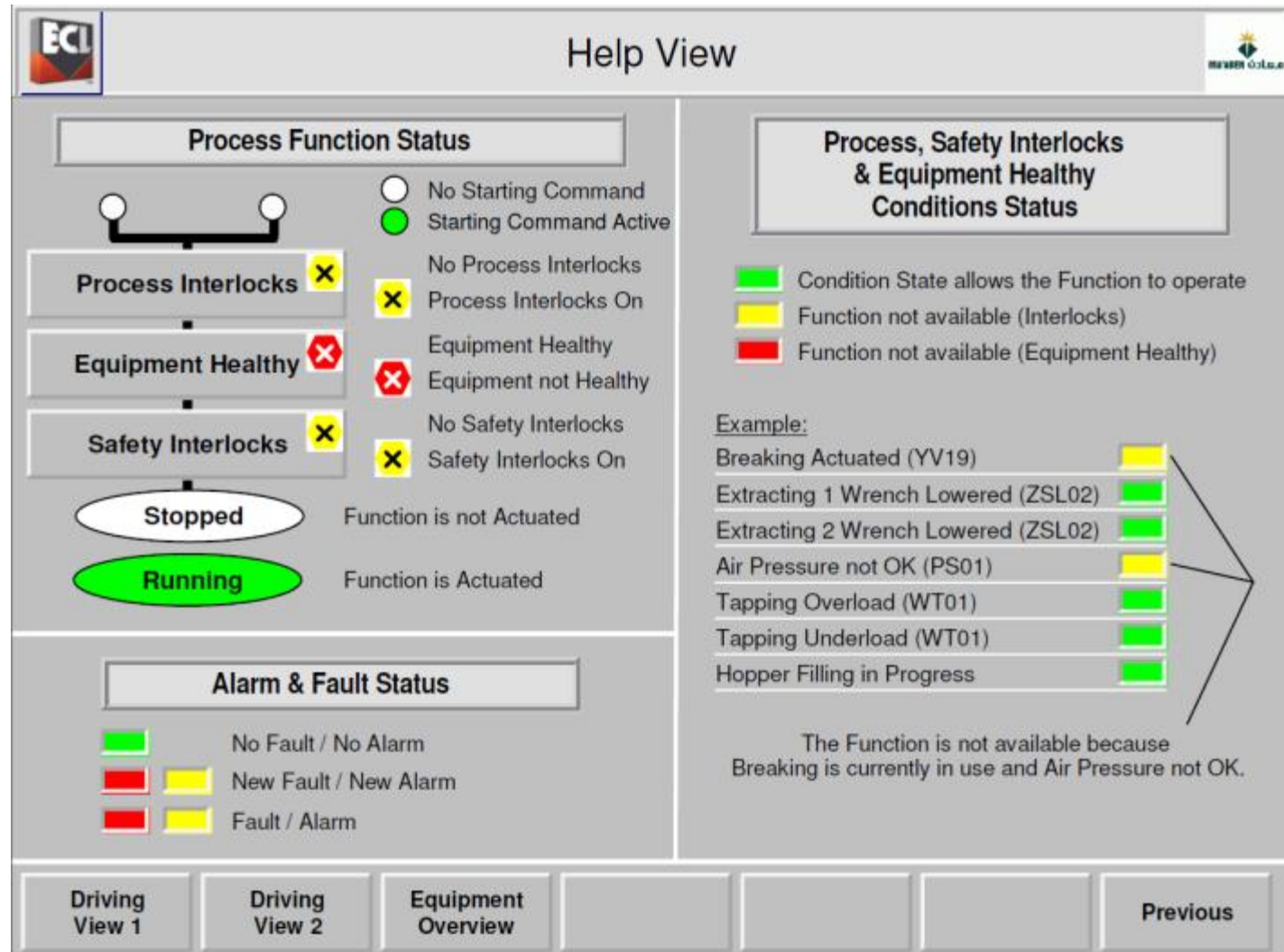
Views => 2 parts



Various information

EQUIPMENT DESCRIPTION

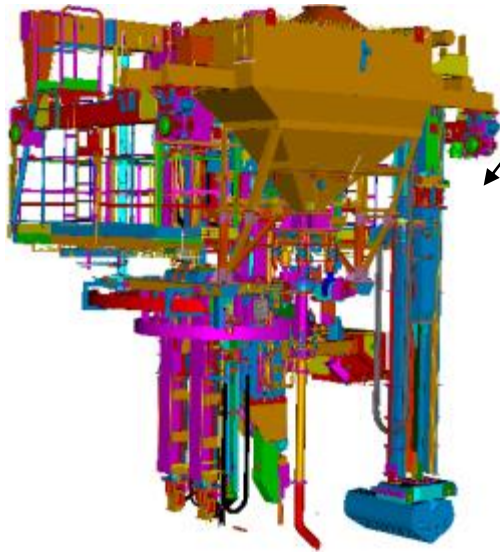
Legende view



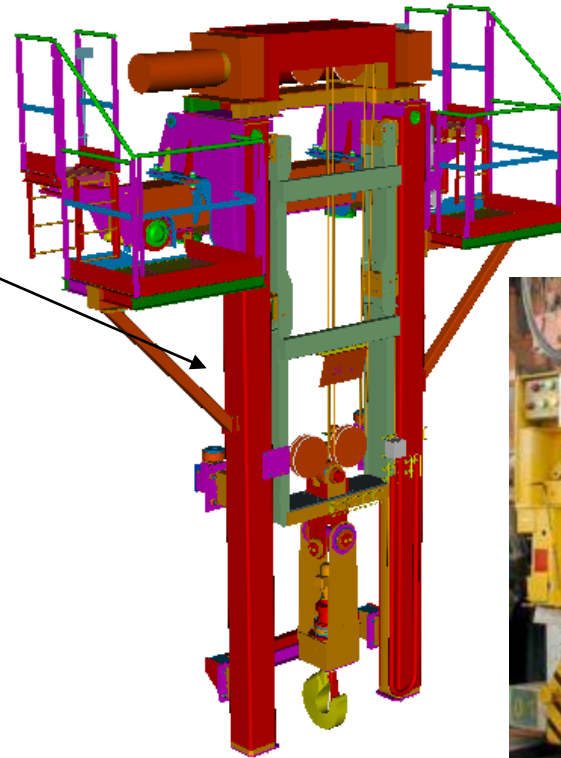
EQUIPMENT DESCRIPTION

Remote radio box

This remote radio box must be use from the ground



ANODE CHANGING



METAL SIPHONING



EQUIPMENT DESCRIPTION

Belt

Positioning
box on
operator



Hip belt.

Change of
the battery



Or strap

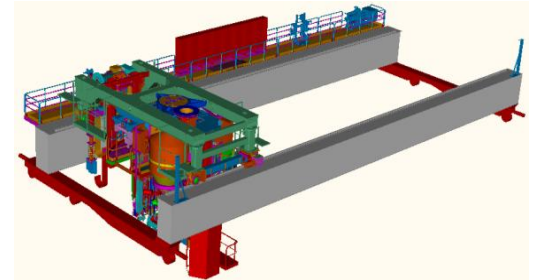
SUMMARY

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5. OPERATING MODE

From cabin (PTA)

From Remote control box (Floor)

6. ALARM & FAULT



OPERATING MODE

The PTA are working under operator's control from cabin and from remote radio box

The operator must:

- › Ensure that the machine is free (no people on the equipment)
- › Ensure the access conditions are OK
- › Visually check the machine conditions
- › Carry out only the operations for which the machine has been designed
- › Respect the safety rules and recommendations in effect on site
- › Take account the message faults
- › In case of faults, advise the maintenance department

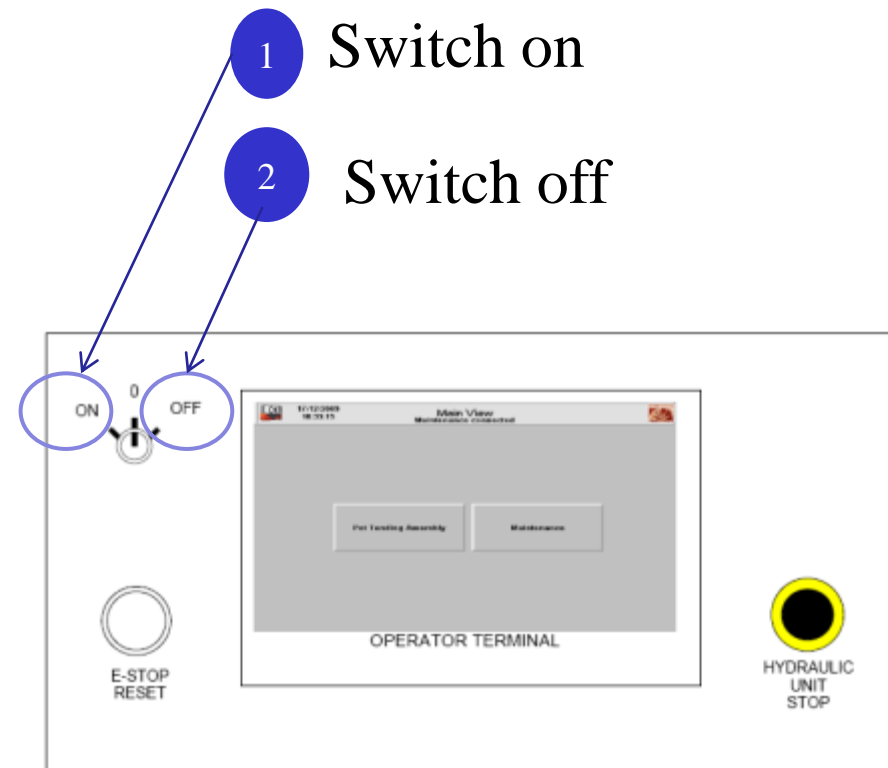
OPERATING MODE

Start / Stop

PRELIMINARY OPERATIONS

The main contactors can be switched on from the cab or from the remote control after satisfying the preliminary conditions:

- The emergency stop relay is reset.
- To reset, press the “E-stop reset” push button
- The cab and the remote control (if the remote is selected) emergency stop push buttons are deactivated (in the cab and on the remote control).
- The selector switch “Maintenance / Service” is on “Service” position (to use for maintenance or test operations).



Cabin

OPERATING MODE

Start / Stop

STARTING UP PROCEDURE

- Unlatch the EMERGENCY 1
- Align transmitter of bow to the receiver (girder)
- Push in the *on button* 2

Remote boxe



Unlatch

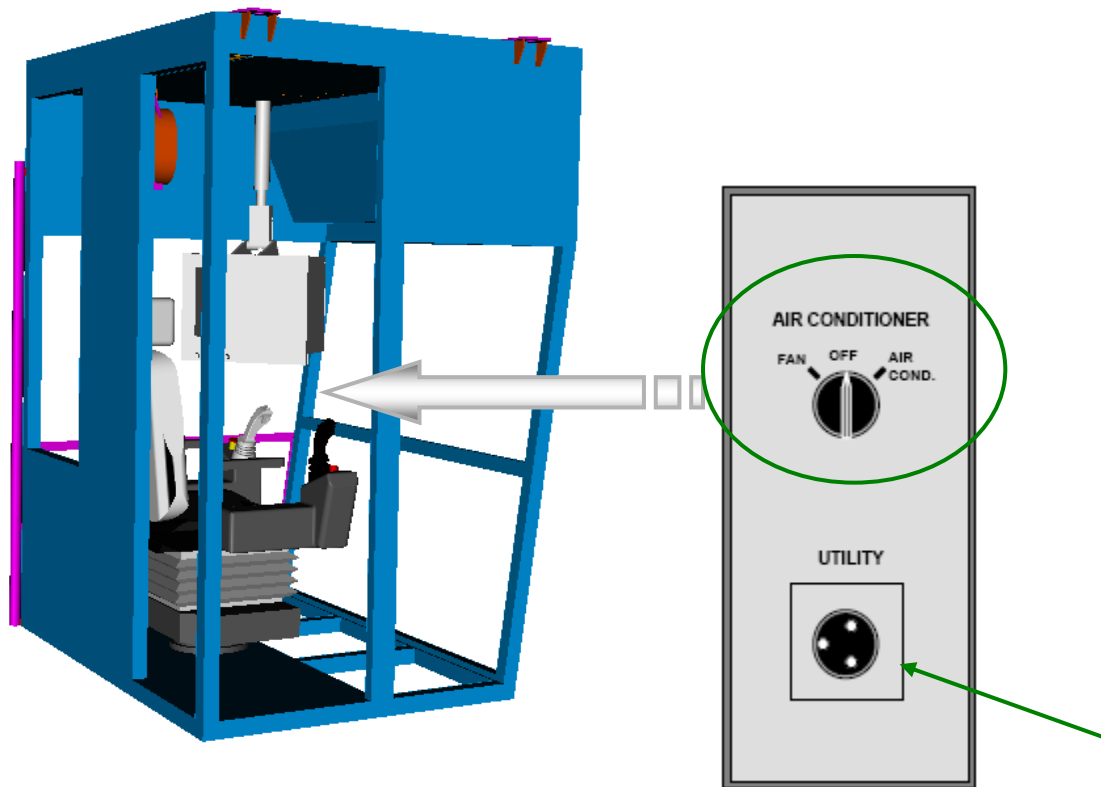
STOP PROCEDURE

- Press off button 3
- Push *EMERGENCY button* 1

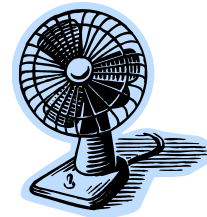


OPERATING MODE

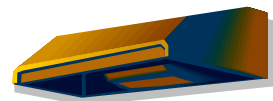
Regulation T°C



Fan => turn left



Air conditioning
=> turn right



Plug

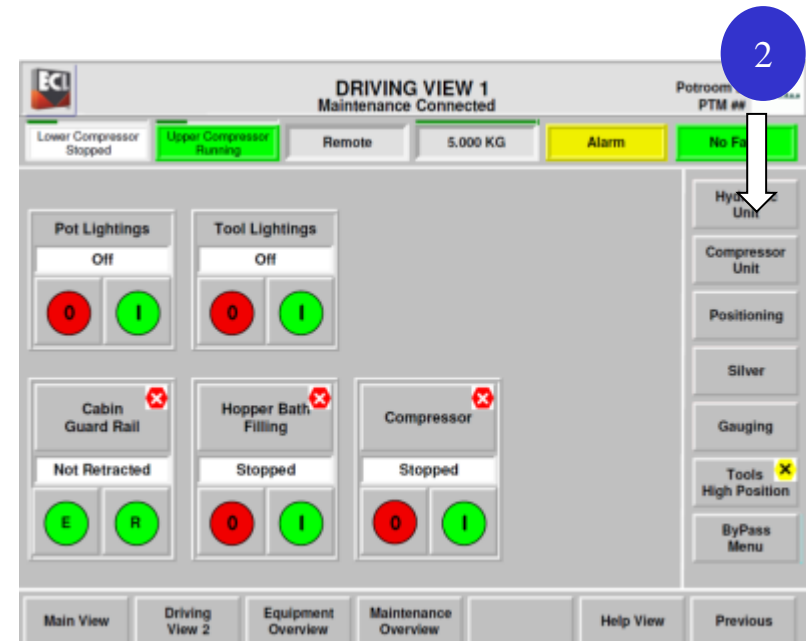
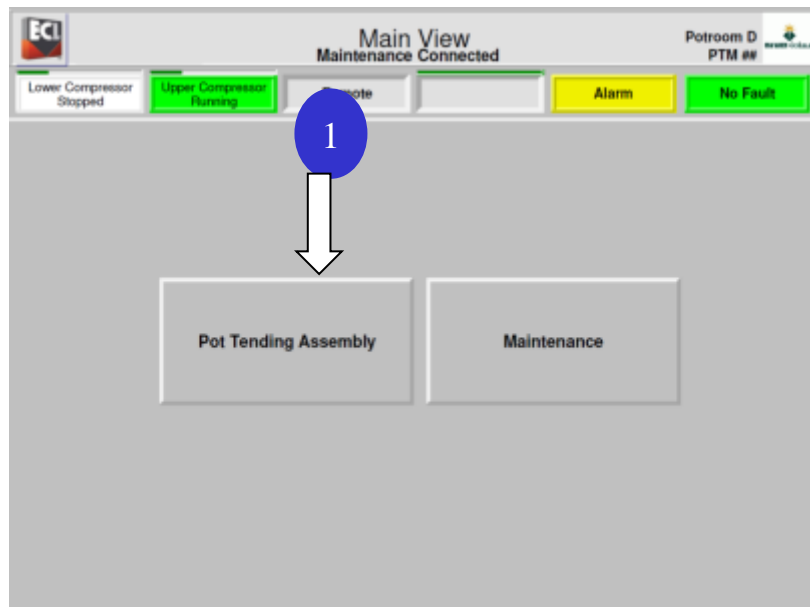
OPERATING MODE

MS 800 series

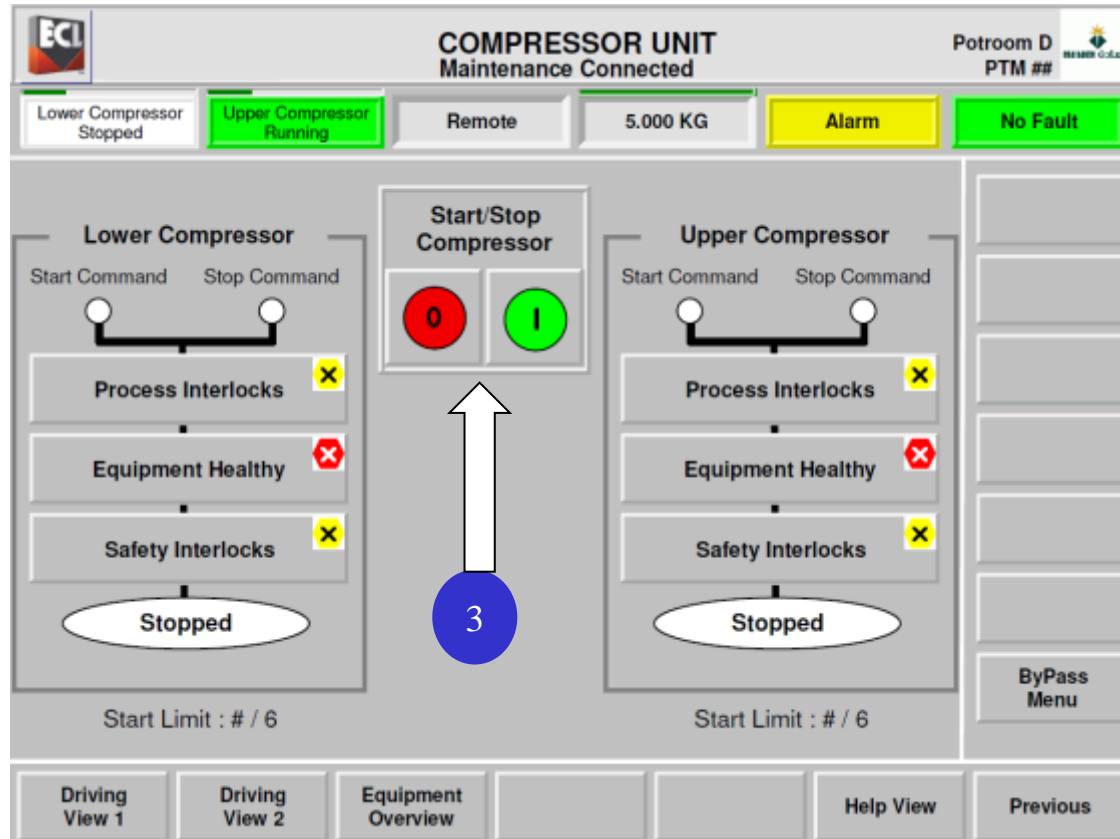


COMPRESSOR

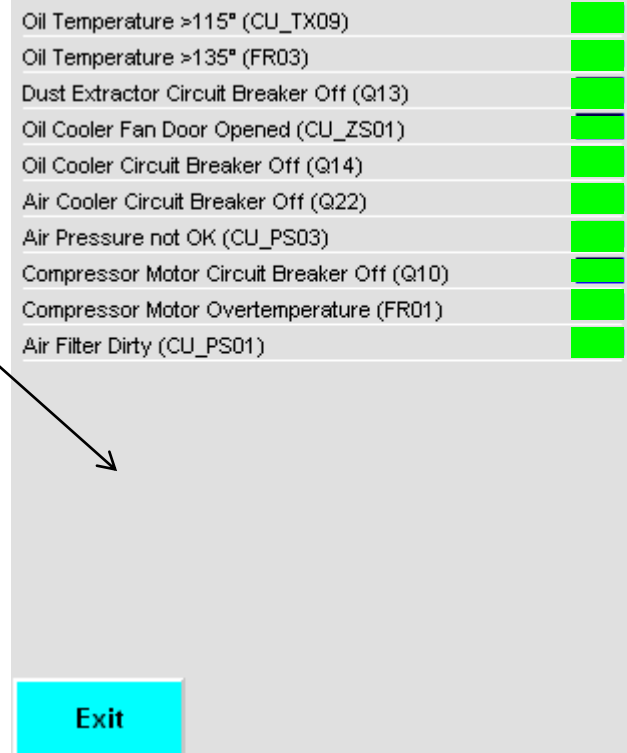
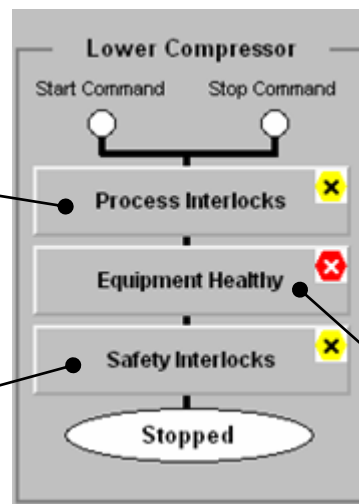
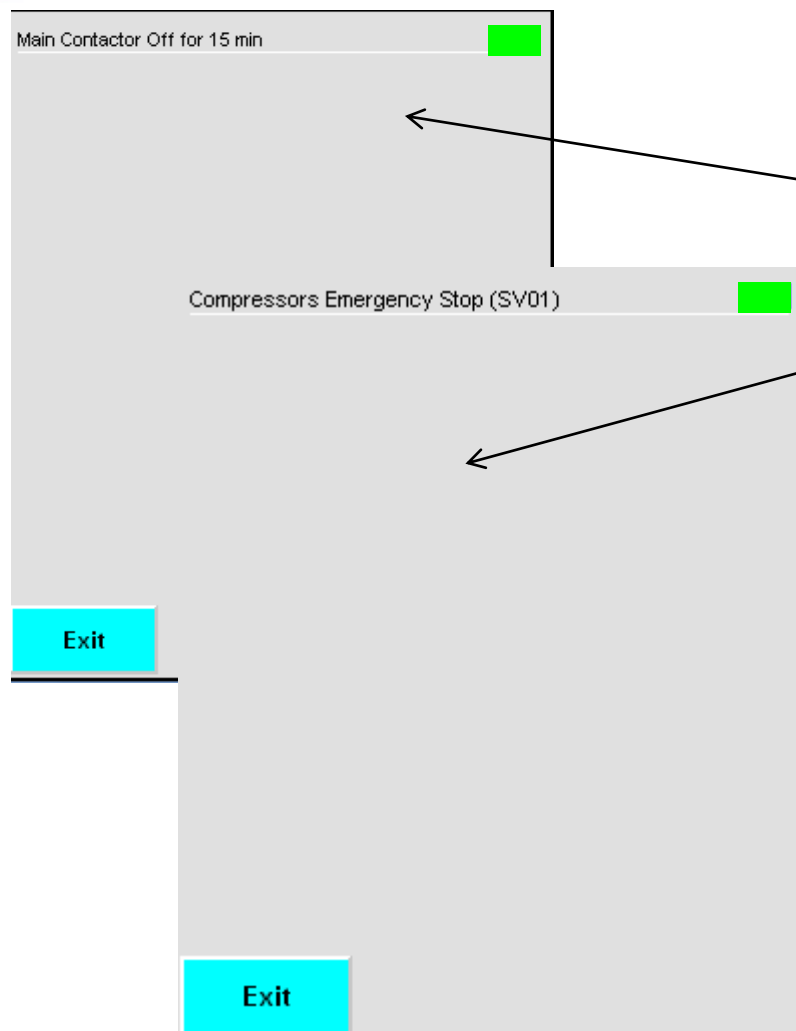
- The operator can start and stop the compressors unit from the cab and from the radio remote box.
- The starting of the two compressors together is forbidden.
- During tapping , both compressor are running



OPERATING MODE




OPERATING MODE



Compressor interlocks

OPERATING MODE

 Warning => when you change the control (Remote box or cabin),
you don't stop the compressor



1

Start (first compressor)

2

Start (second compressor)

MS 800 series

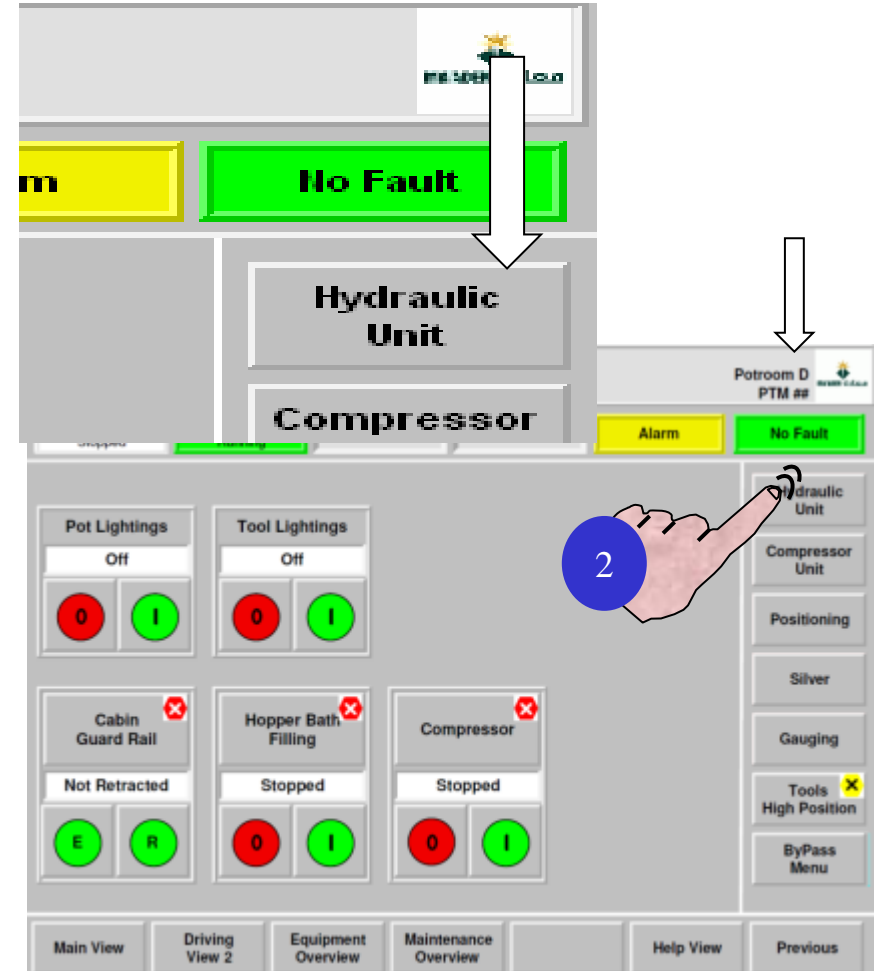
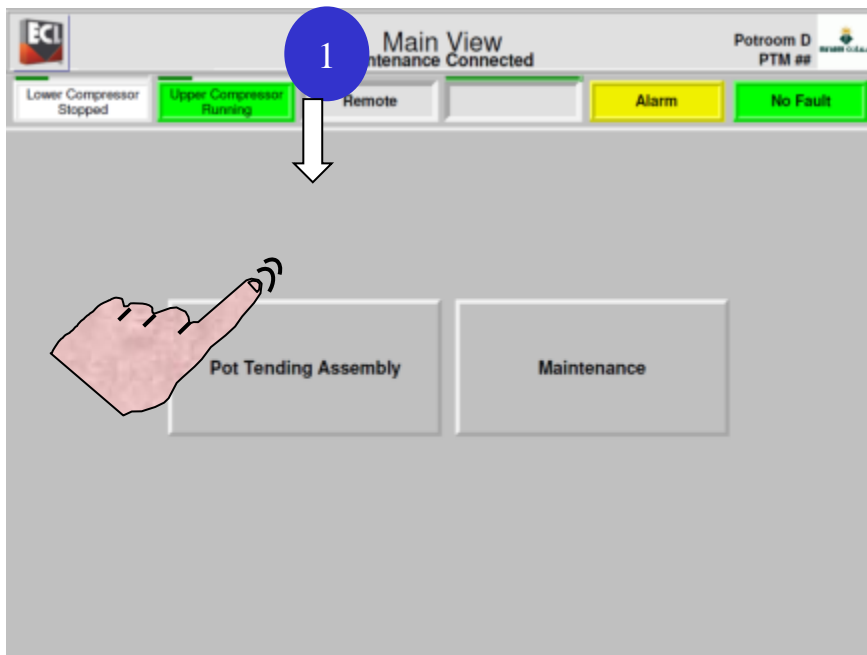


OPERATING MODE

HYDRAULIC UNIT

- The hydraulic unit starts automatically when a hydraulic motion is required by the operator (anode extraction, breaking up...).
- The hydraulic unit will not start if the operating conditions are not correct.
- The hydraulic unit will stop automatically 3 minutes after the end of hydraulic motion and if any other hydraulic motion is required by the operator.
- In case of fault, the hydraulic unit will be immediately stopped and a message appears on the “ALARMS & FAULTS HISTORY” screen

OPERATING MODE



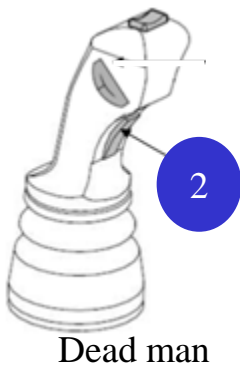
OPERATING MODE

LONG TRAVEL

- The long travel motions are controlled by means of the left joystick.
- To stop the motion, bring the joystick handle in neutral position.
- While actuating the dead-man lever switch, push forward the joystick for the front long travel motion or pull backward the joystick for the rear long travel motion.
- To inform of the machine displacement, the operator can actuate the horn, located in the right joystick.
- See operating conditions by clicking on Process Interlocks (see the following Panel views).

OPERATING MODE

LONG TRAVEL



LEFT CONTROL PULPIT

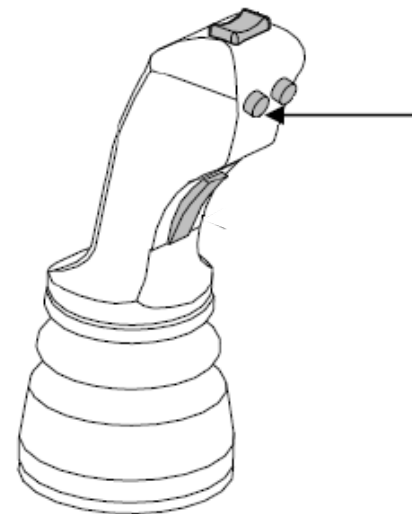


↑
FORWARD
LONG
TRAVEL

↓
BACKWARD
LONG
TRAVEL

**THE SPEED IS PROPORTIONAL TO THE
JOYSTICK STROKE**

RIGHT JOYSTICK

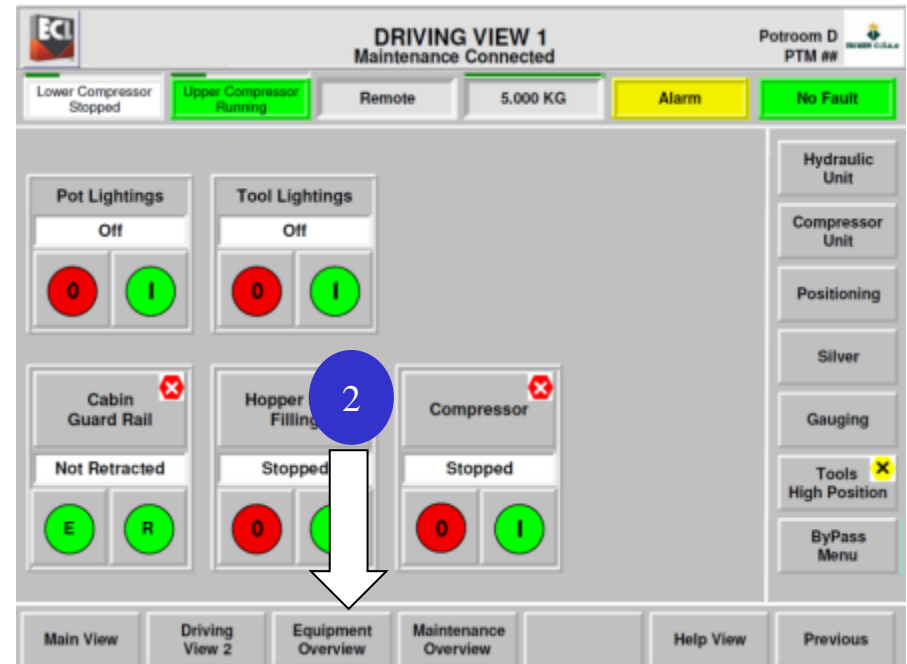
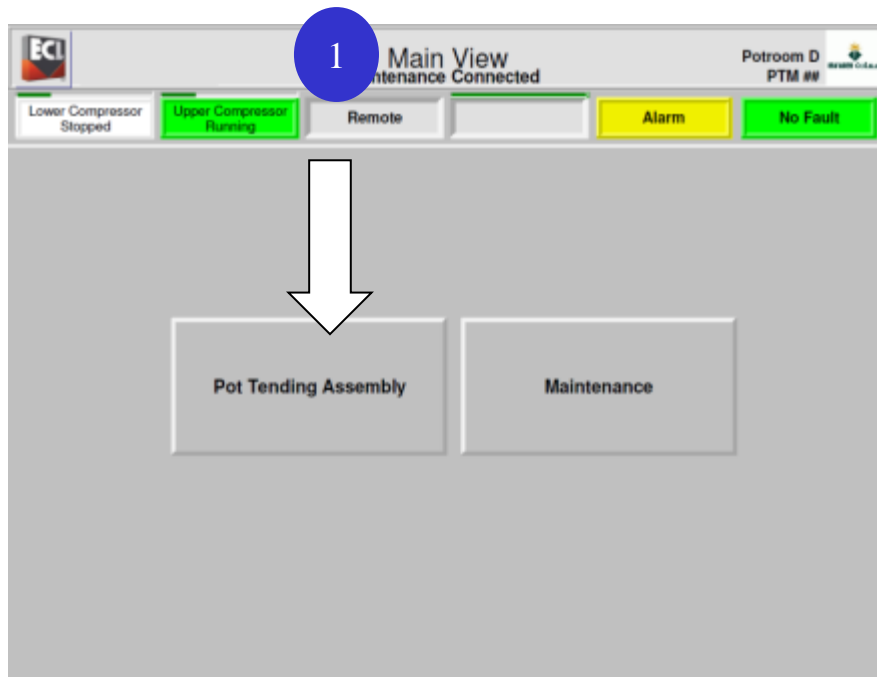


HORN

1

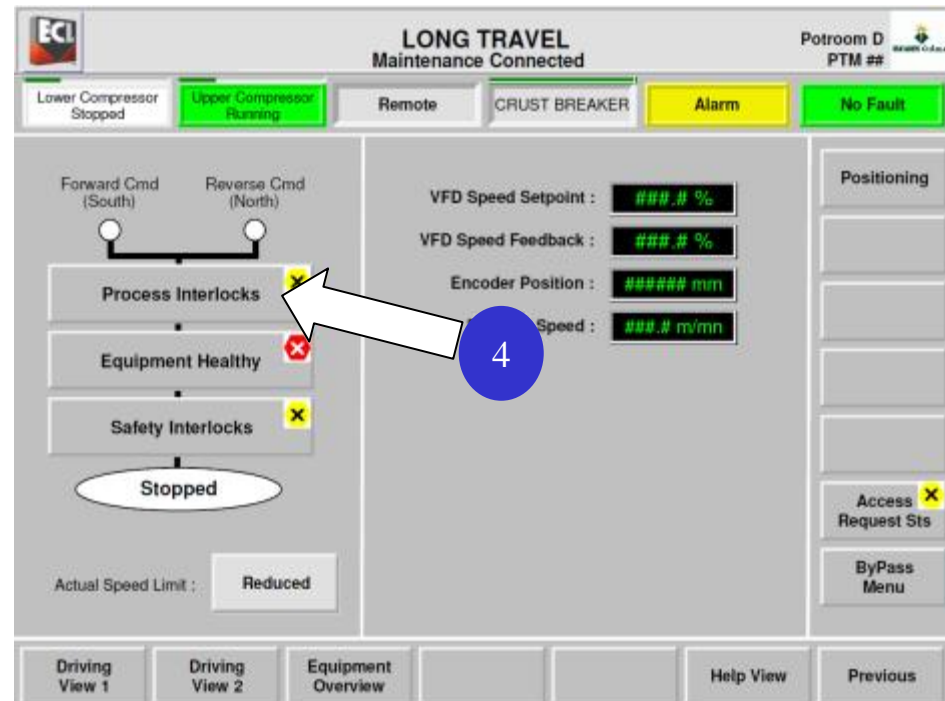
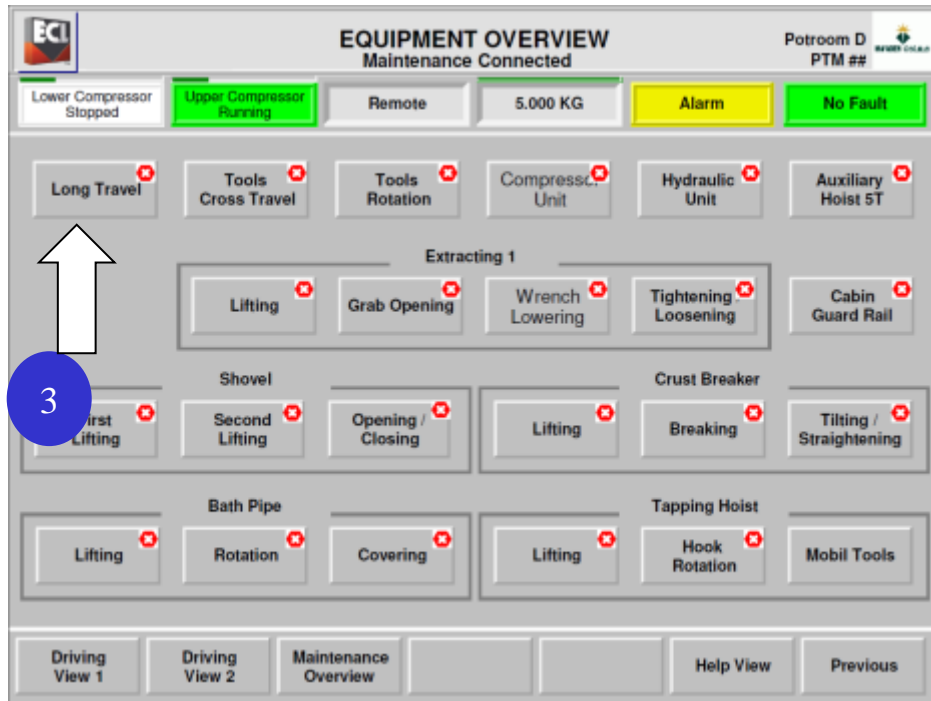
OPERATING MODE

Operating condition for the long travel



OPERATING MODE

Operating condition for the long travel



OPERATING MODE

LONG TRAVEL

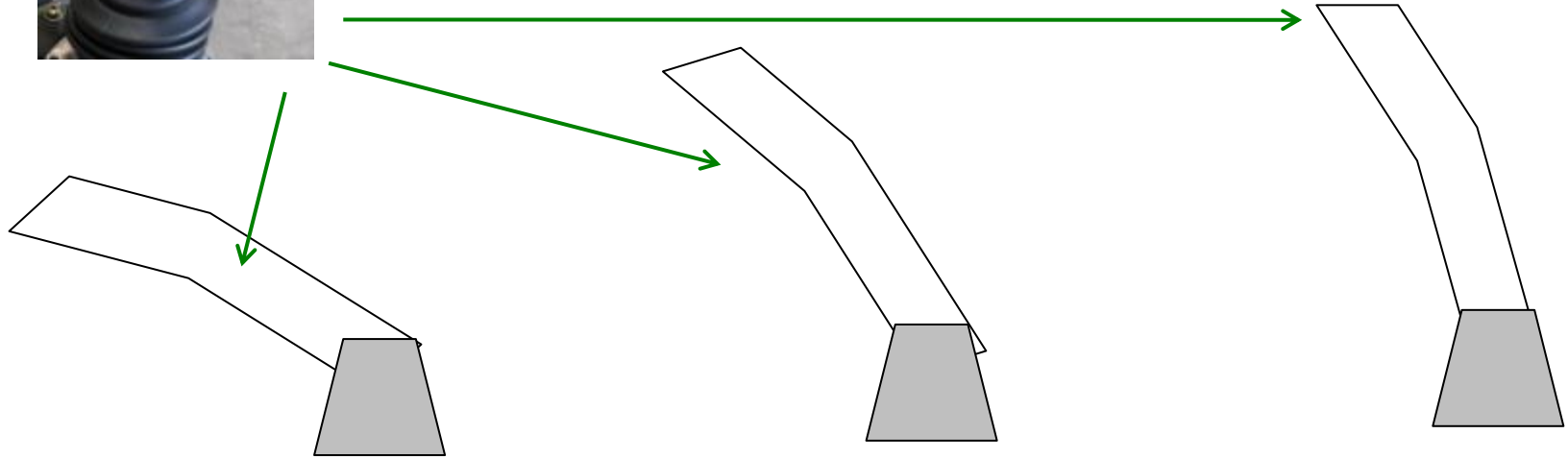
- The long travel motion is controlled by pushing forward or backward the left joystick handle.
- To stop the motion, bring the joystick handle in neutral position.
- To inform of the machine displacement, the operator can actuate the horn by pressing on the push-button located on right side of the remote radio box.



Horn is automatic at the beginning of each movement

OPERATING MODE

Proportional speed account



Maximum position

Intermediaire position

Initiale position

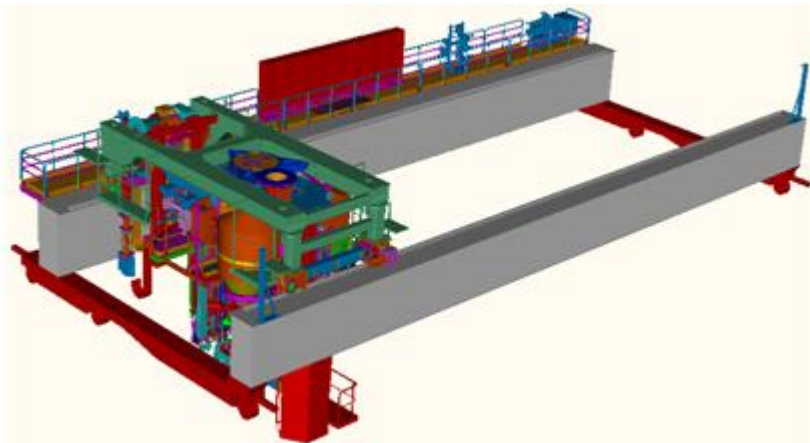
100%
Maximal speed

No moving

OPERATING MODE

ANTICOLLISION

- A photoelectric cell on each extremity of the PTM protects against collision.
- In case of anti-collision detection with another machine or bumper, the long travel motion is automatically stopped in the direction where anti-collision has been detected. In the same time, a message is displayed on the operator terminal

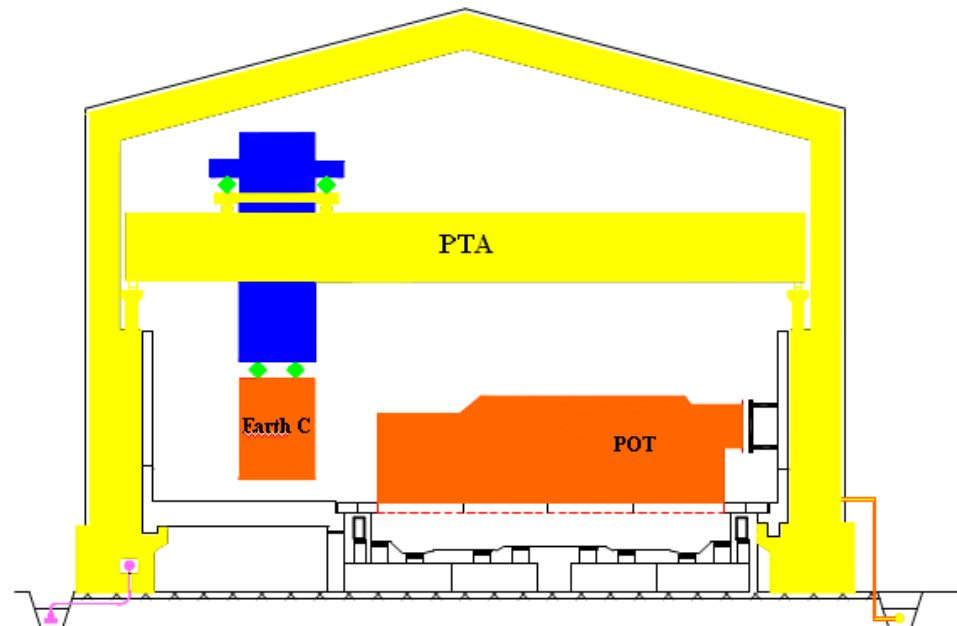


OPERATING MODE


INSULATION FAULT

In case of insulation fault detection, the operator has to bypass the defect by pressing on the touch “BY-PASS” from cabin or from remote

The insulation fault is bypassed during 1min




OPERATING MODE



SILVER
 Maintenance Connected

Potroom D
 PTM ##



Lower Compressor
Stopped

Upper Compressor
Running

PTM Off

CRUST BREAKER

Alarm

No Fault

Structure Test

A - C

C - D

C - E

Power Test

NT - C

NT - D

NT - E

Alarms

Structure alarm

Power fault

Faults

Structure fault

IPC fault

PNOZ Multi fault

ByPass Menu

Driving View 1

Driving View 2

Equipment Overview

Help View

Previous

This page is used to check the insulation

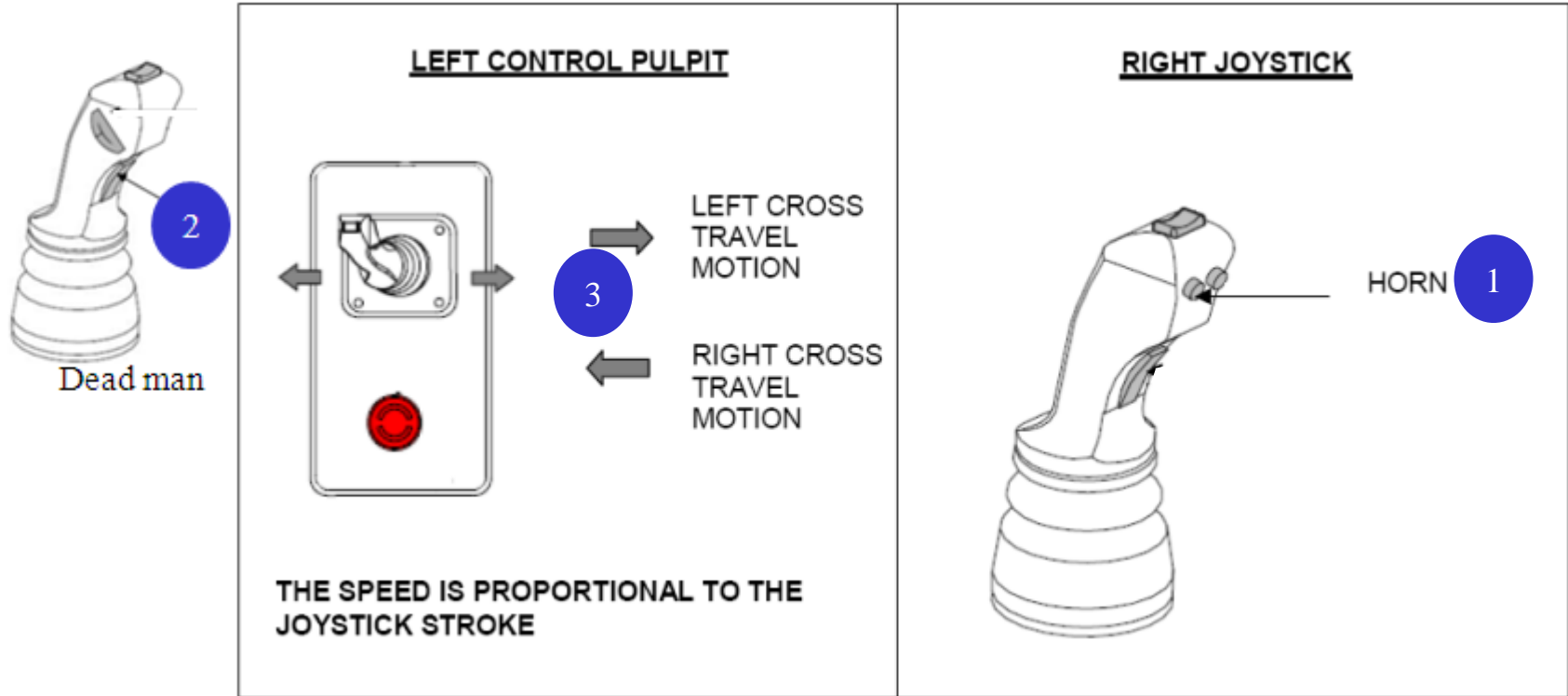
OPERATING MODE

CROSS TRAVEL

- The cross travel motion is controlled by means of the left joystick.
- To stop the motion, bring the joystick handle in neutral position.
- While actuating the dead-man lever switch, push the joystick to the right for the right cross travel motion or push the joystick to the left for the left cross travel motion.
- To inform of the machine displacement, the operator can actuate the horn by pressing on the left push-button located on front of the right joystick.

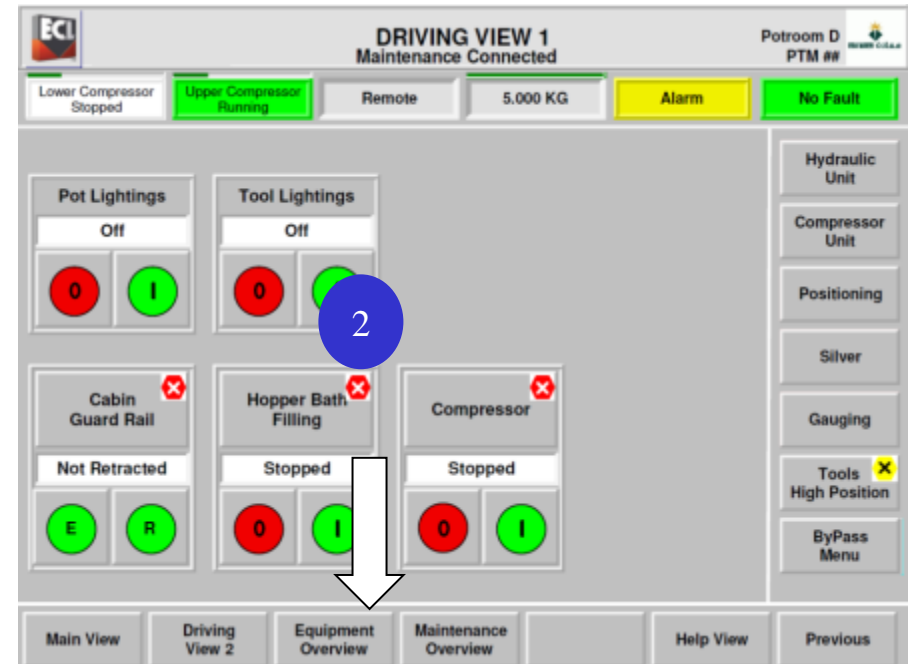
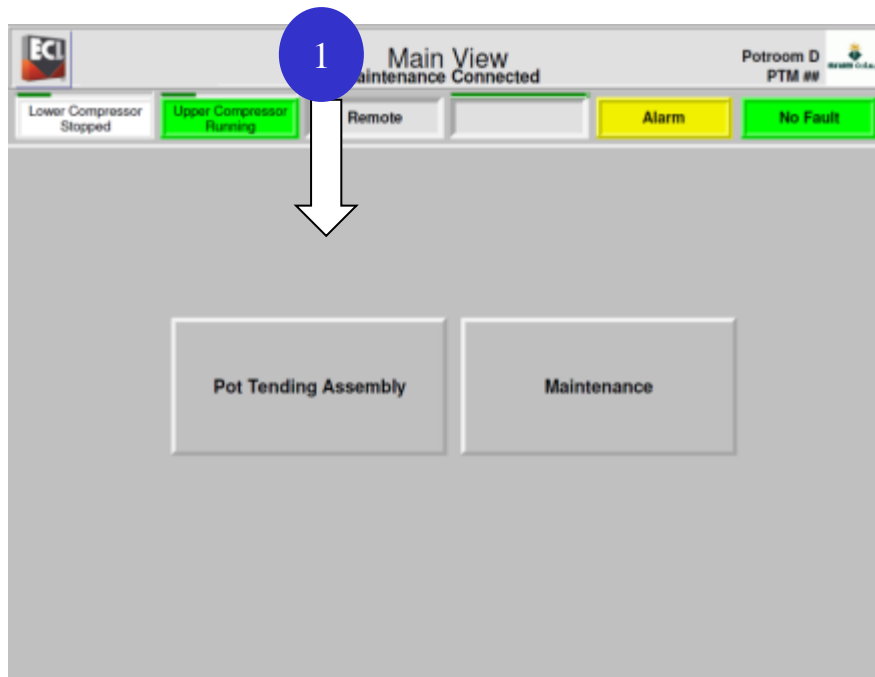
OPERATING MODE

CROSS TRAVEL

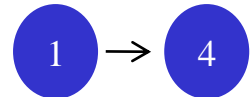


OPERATING MODE

operating conditions – cross travel

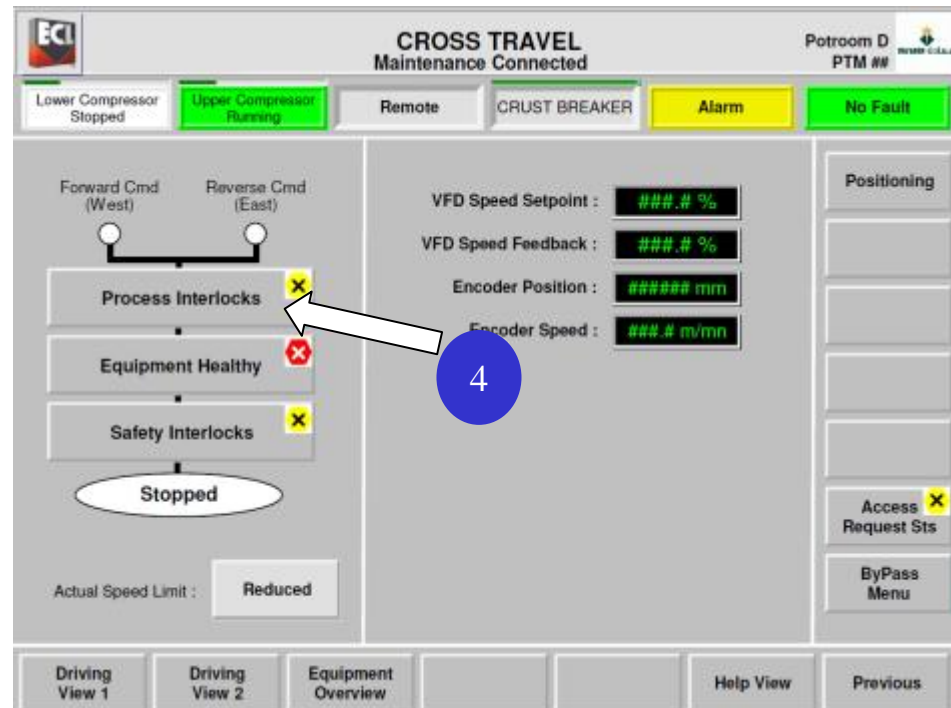
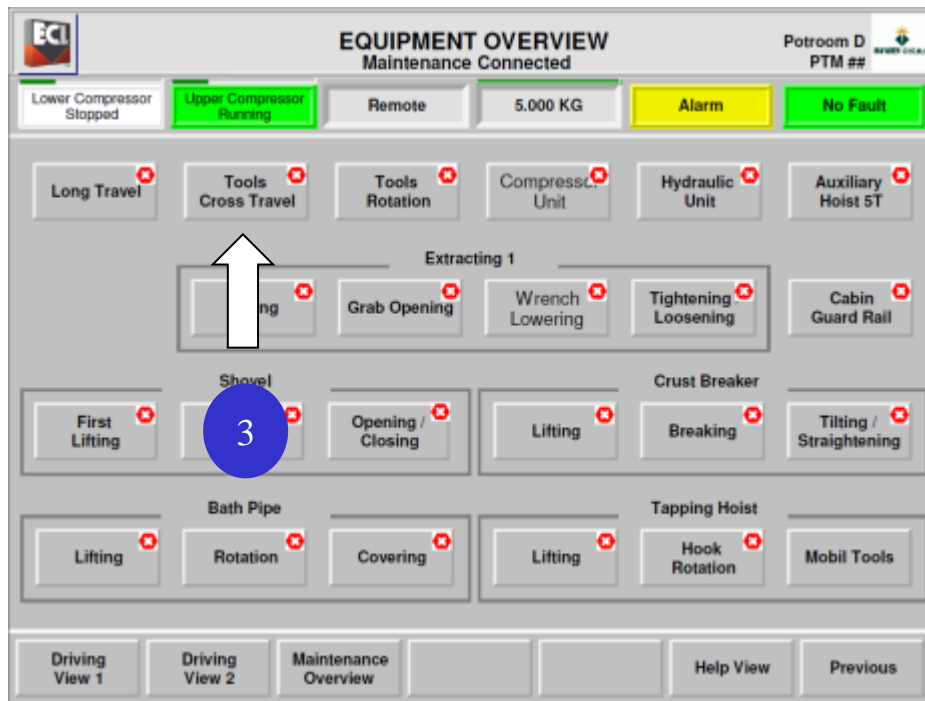


Realise the steps following



OPERATING MODE

operating conditions – cross travel



OPERATING MODE

cross travel

- The cross travel motion is controlled by the left joystick.
- To stop the motion, bring the joystick handle in neutral position.
- To inform of the machine displacement, the operator can actuate the horn by pressing on the push-button located on right side of the remote radio box.



For the safety
You must used the « horn »
before the moving



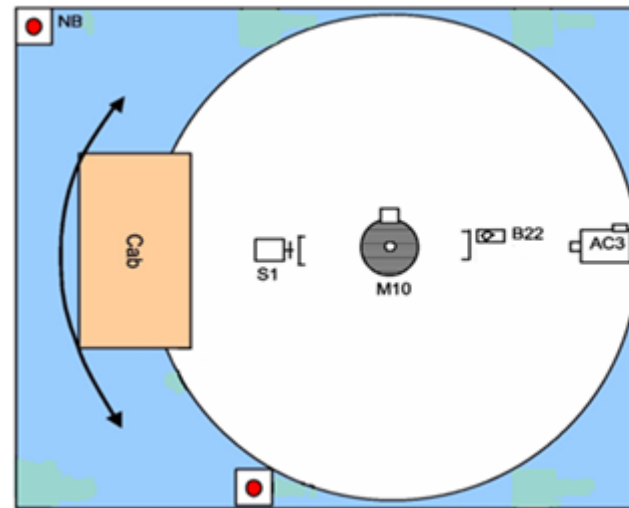
OPERATING MODE

TOOLS & CABINE ROTATION

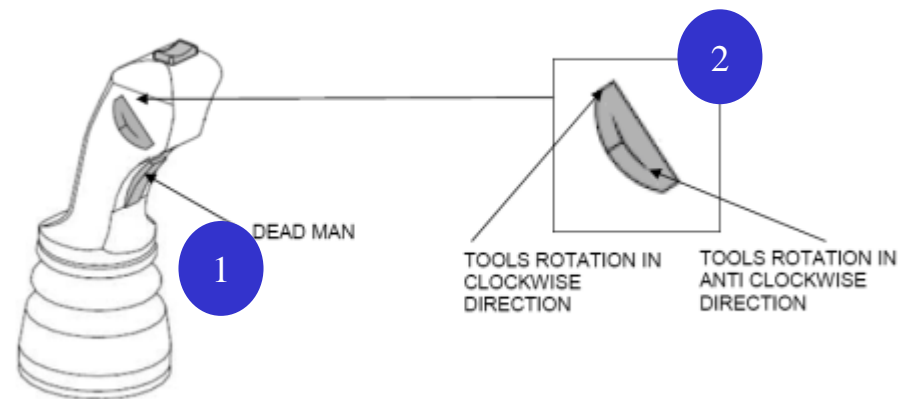
➤ Tools rotation => left joystick.

➤ While actuating the dead-man lever switch, push to the left or to the right the toggle switch located on the right side of the left joystick.

➤ Operating conditions =>
Interlocks



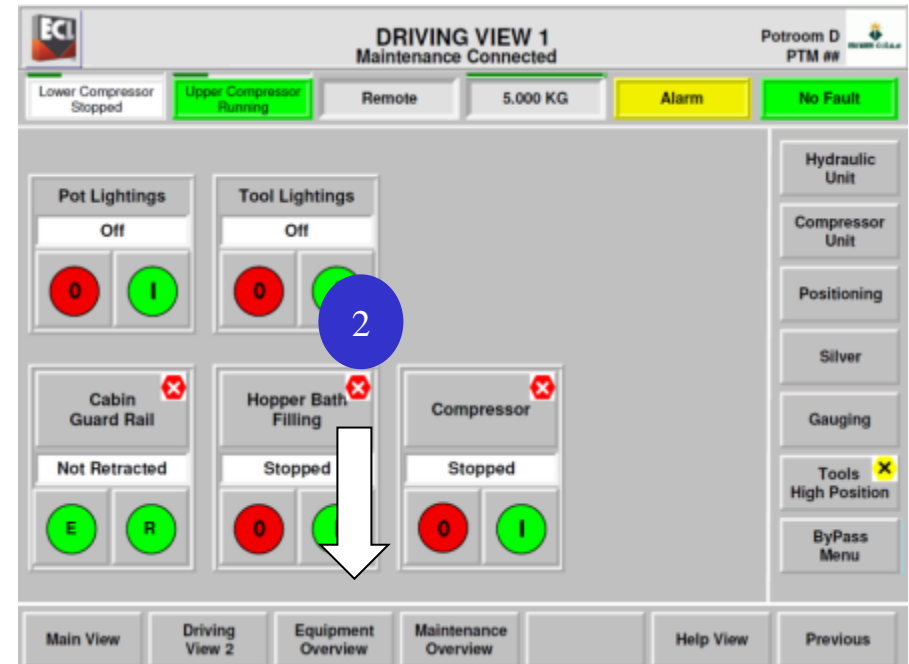
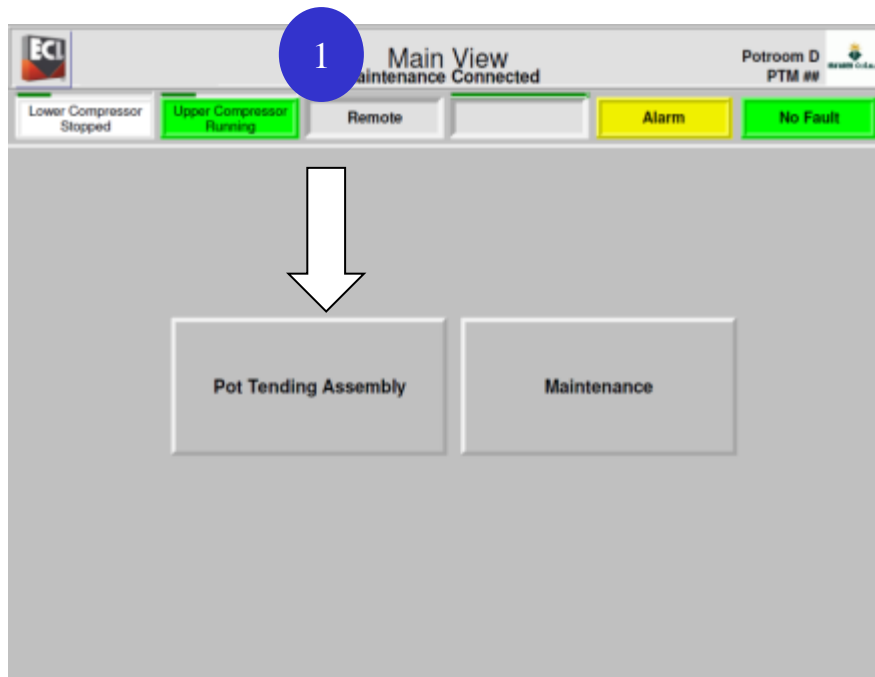
LEFT JOYSTICK



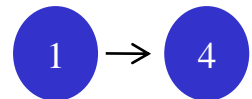
THE SPEED IS PROPORTIONAL TO THE JOYSTICK STROKE

OPERATING MODE

operating conditions – Tools & cabin rotation

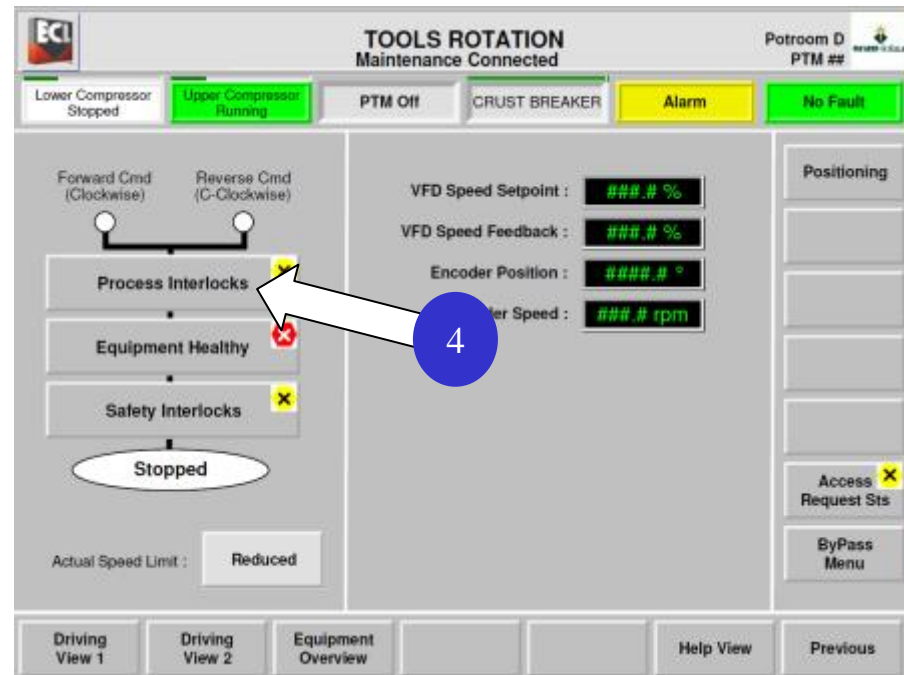
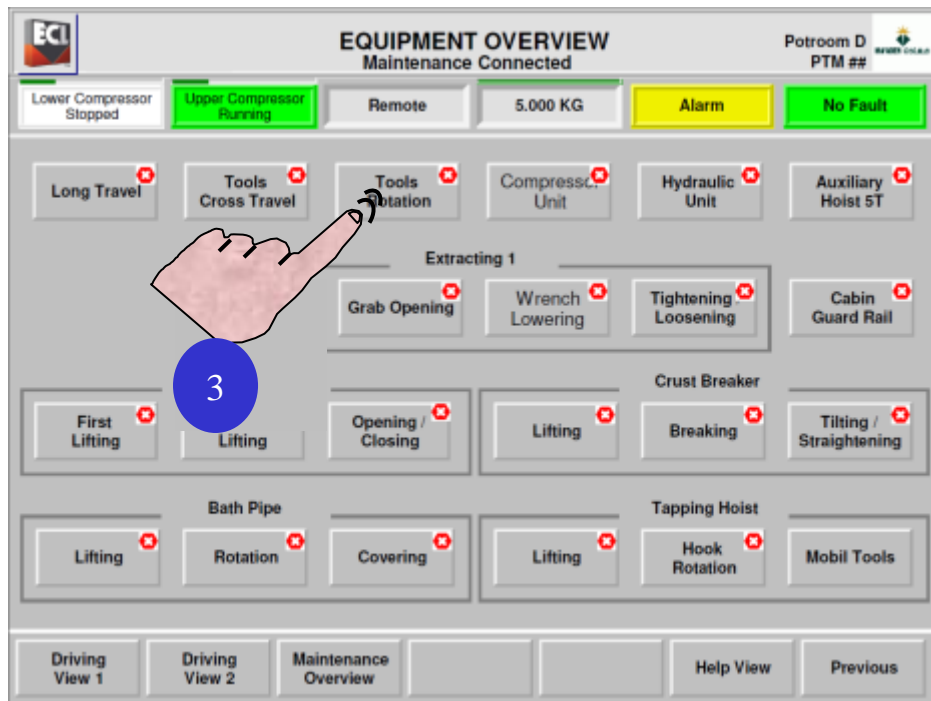


Realise the steps following



OPERATING MODE

operating conditions – Tools & cabin rotation



OPERATING MODE

Tools & cabin rotation

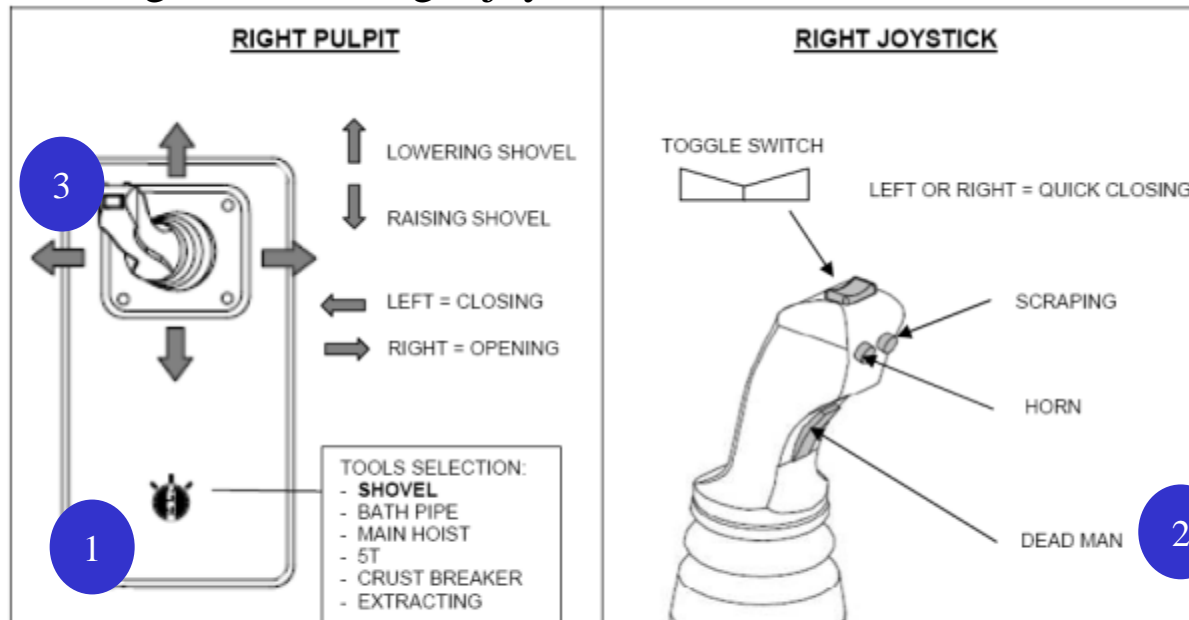


The tools rotation
is controlled by means
of the left joystick

OPERATING MODE

CLEANING SHOVEL

Cleaning shovel => right joystick when tools selection is on “SHOVEL



QUICK CLOSING

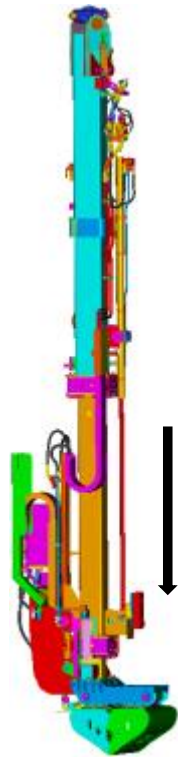
The quick closing motion of the shovel are controlled by the right joystick, by pressing the toggle on left position and DEADMAN lever switch

OPERATING MODE

Shovel cycle



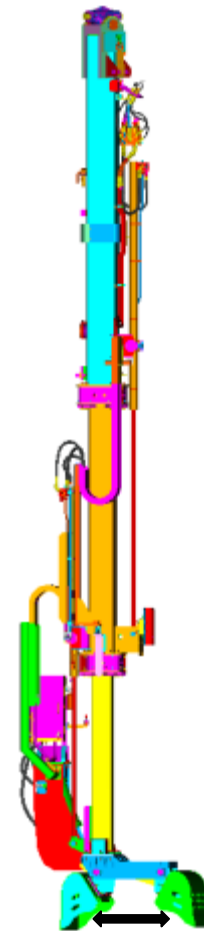
Close
Up position



1^{er} Lifting



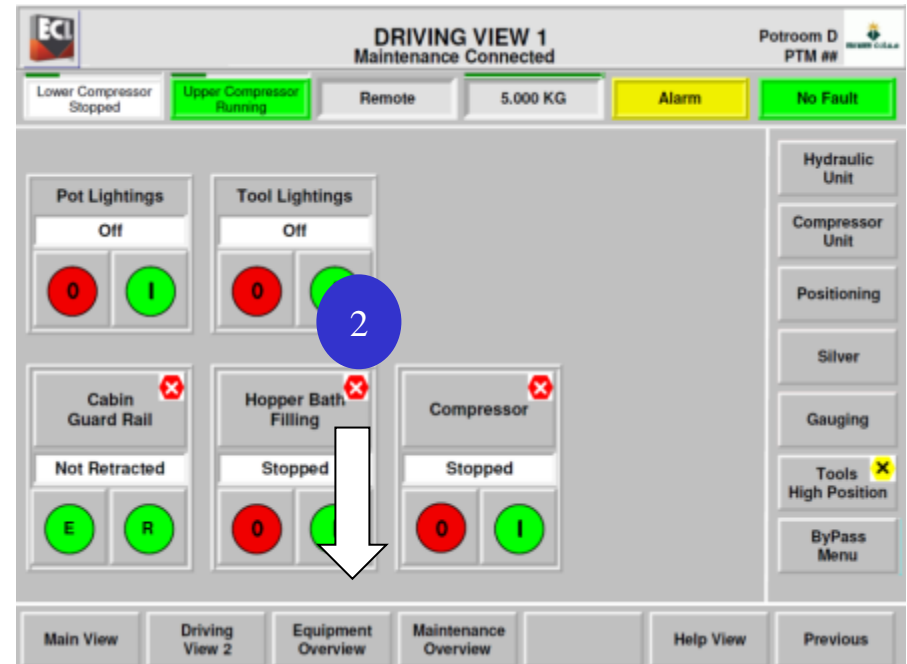
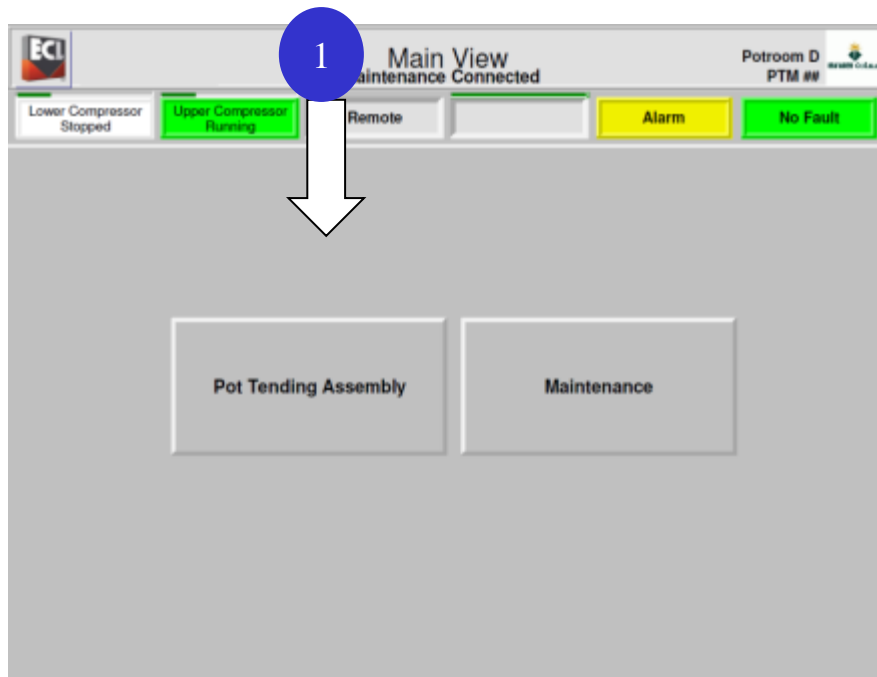
2^{sd} Lifting



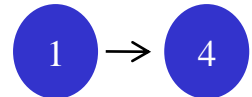
Open

OPERATING MODE

operating conditions – Shovel

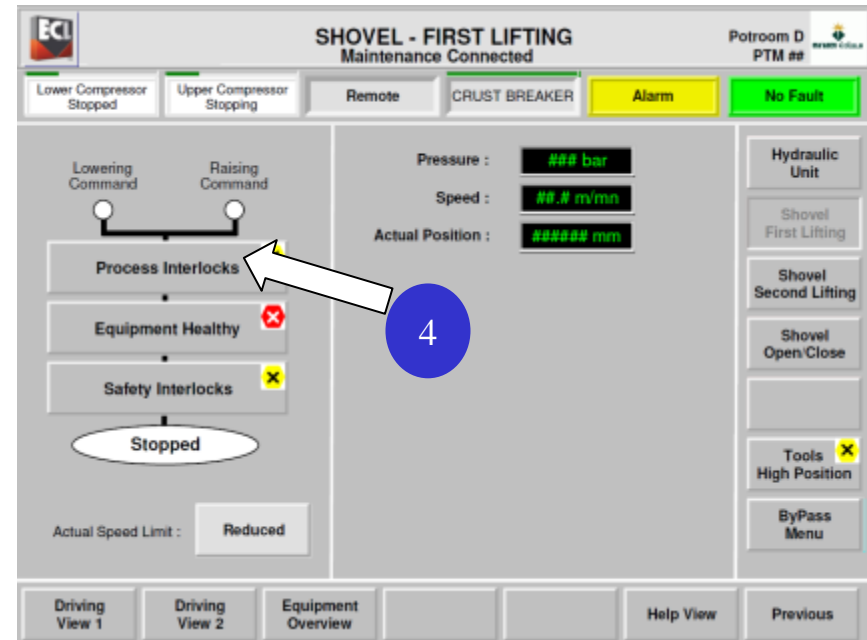
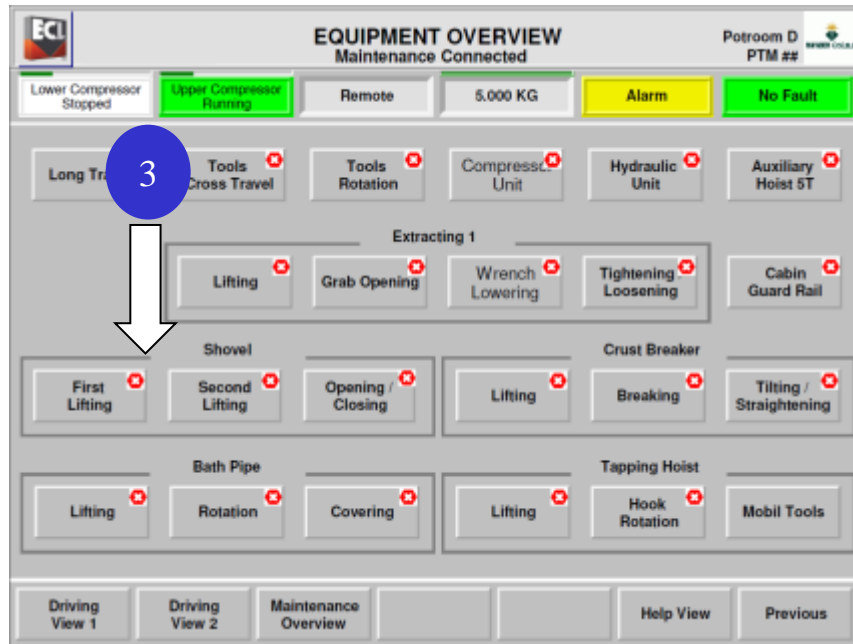


Realise the steps following



OPERATING MODE

operating conditions – Shovel

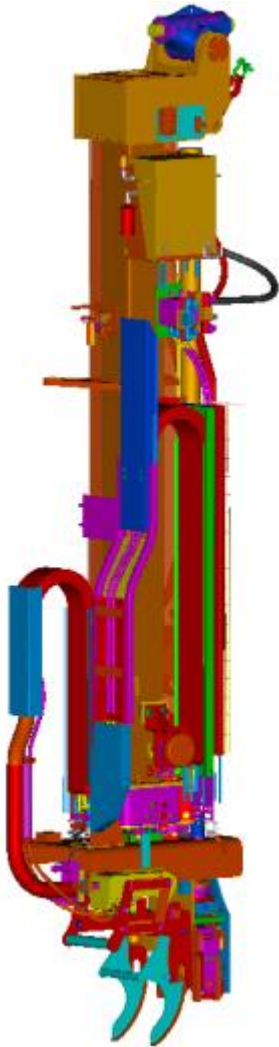


OPERATING MODE

ANODE EXTRACTING DEVICE

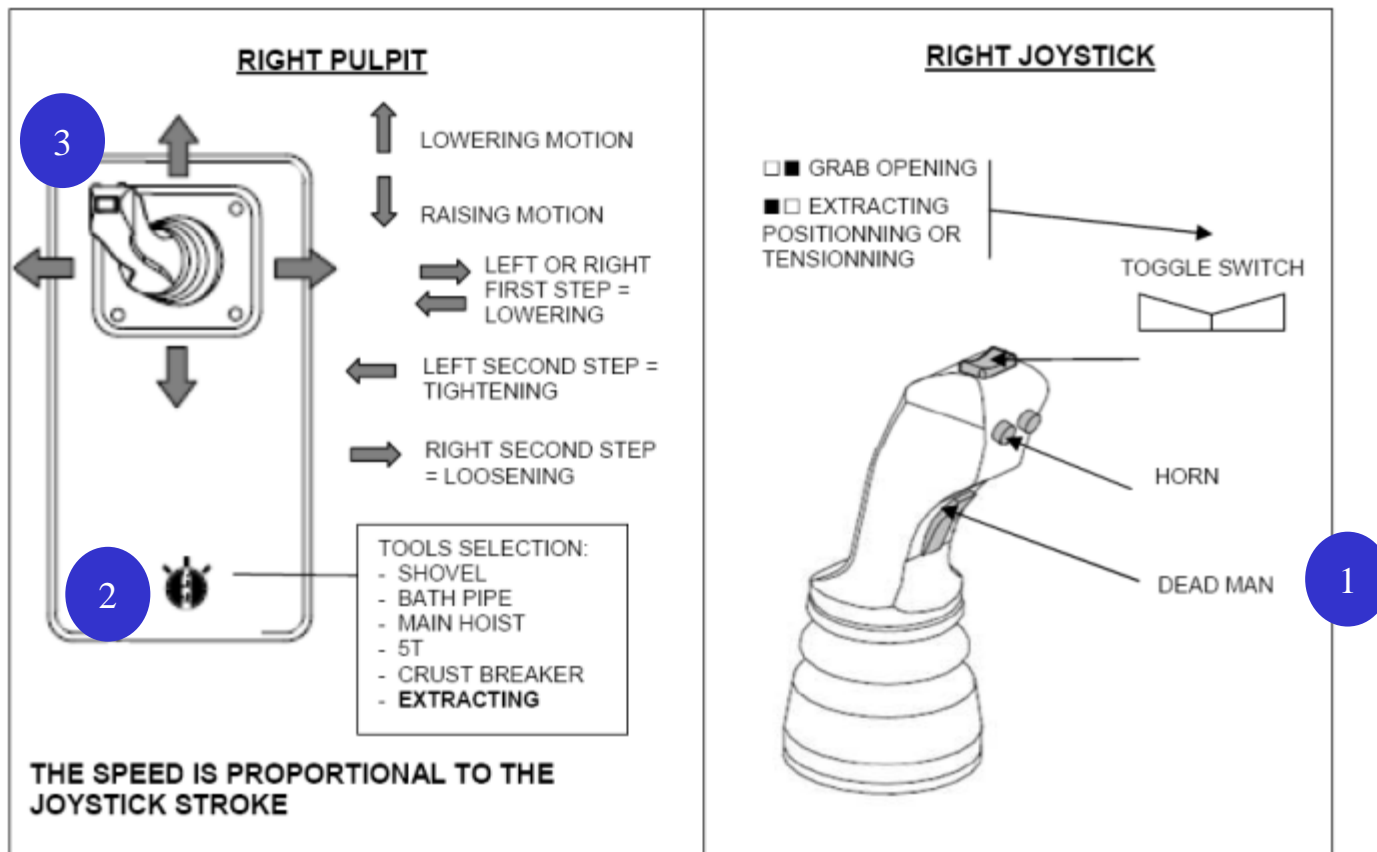
Extracting and tightening device => right joystick when tools selection is on “EXTRACTING”.

- Push the joystick forward => extracting lowering + pull the joystick backward => extracting raising motion.
- During the extracting lowering or raising motion, press the left side toggle switch to position the new anode on the pot with a very low speed.
- Press the left side toggle switch to put the stem in tension.
- Press the right side toggle switch for grab opening.
- Push the joystick on the left or right (1st stroke) for Wrench clamp lowering.
- Push the joystick on the left (2nd stroke) for Wrench key tightening.
- Push the joystick on the right (2nd stroke) for Wrench key loosening.



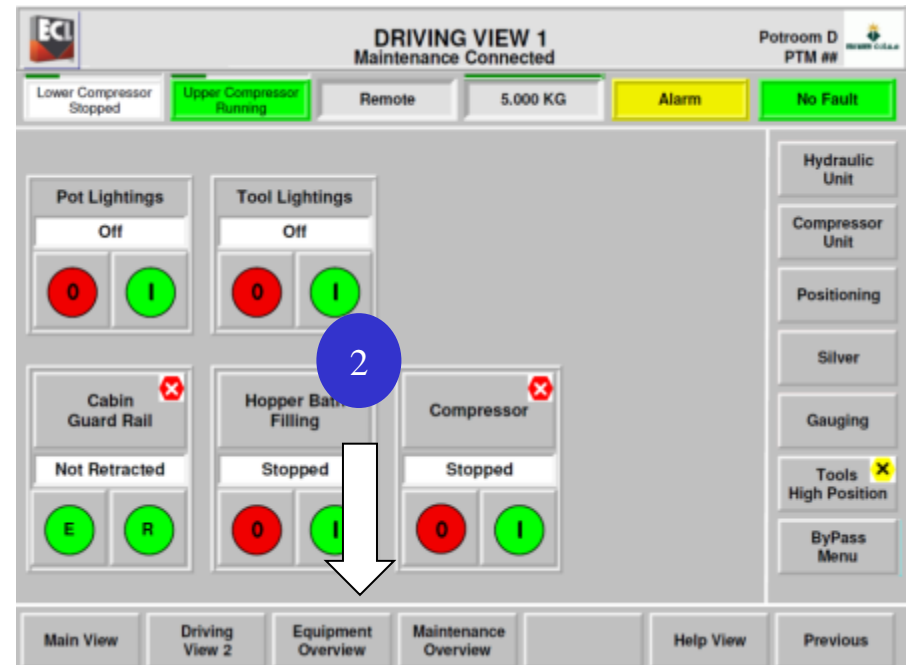
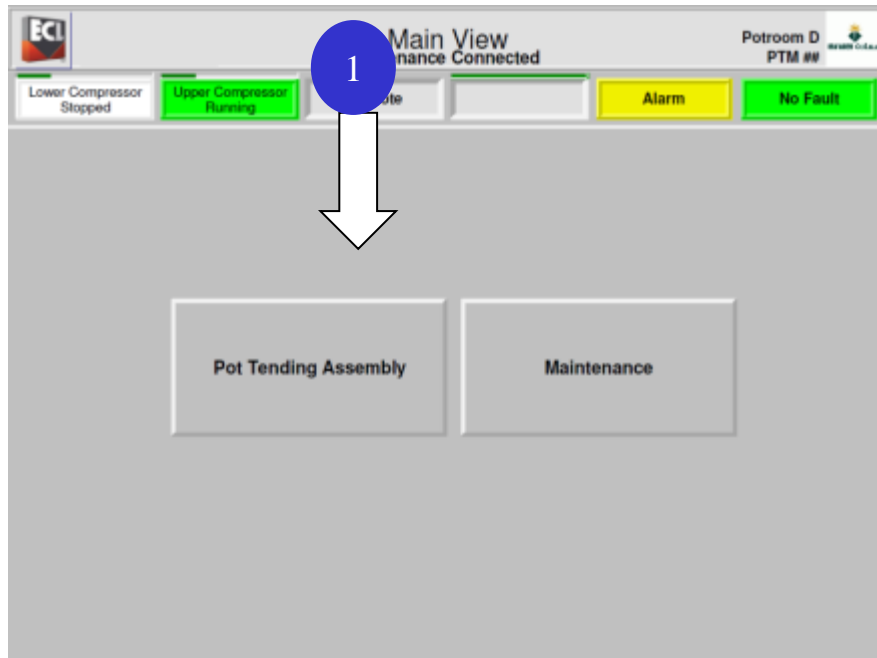
OPERATING MODE

ANODE EXTRACTING DEVICE

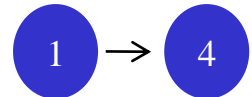


OPERATING MODE

operating conditions – Extracting

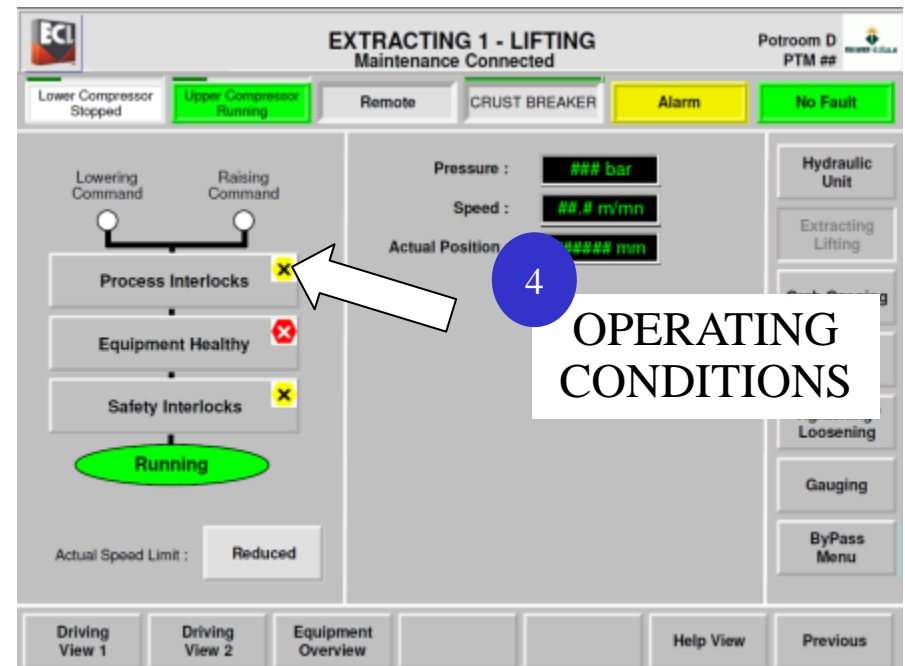
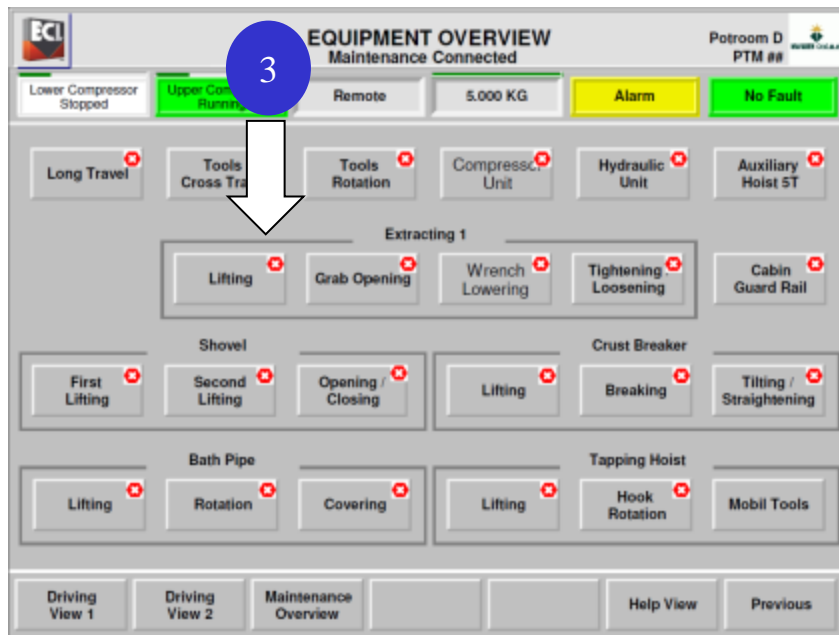


Realise the steps following



OPERATING MODE

operating conditions – Extracting



OPERATING MODE

ANODE EXTRACTING DEVICE

Grab opening



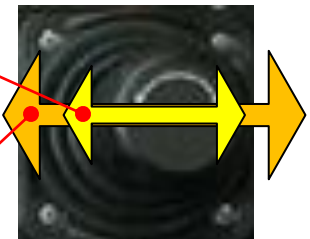
Opening => push
Closing => Release



Extracting
raising / lowering



Wrench



Raising / lowering

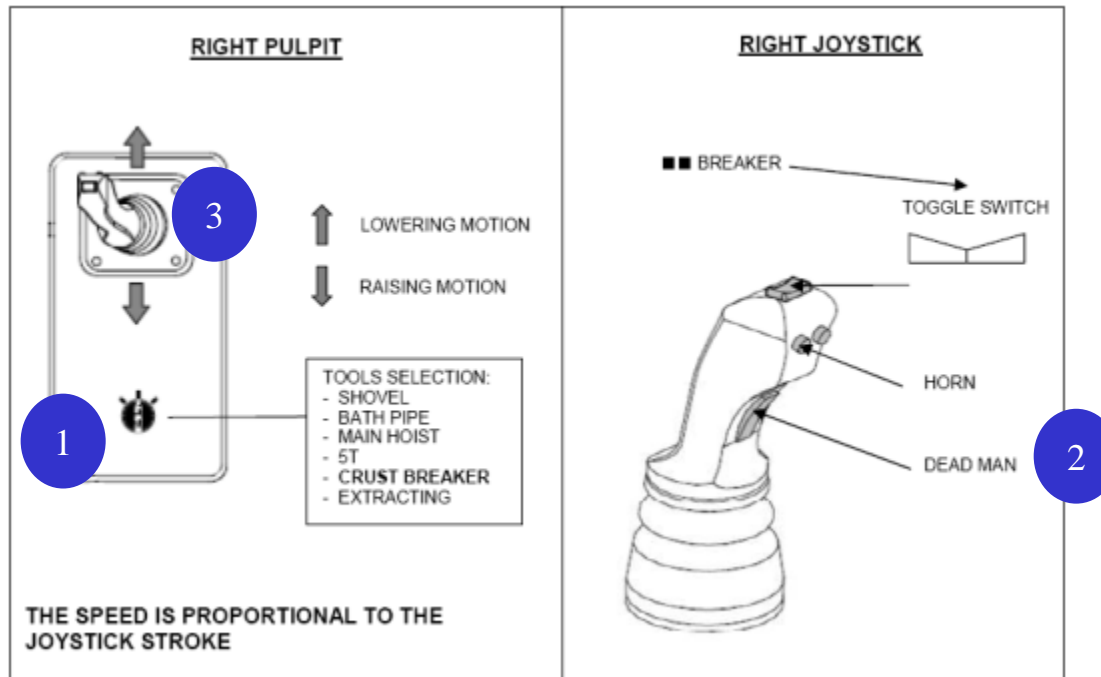
Tightening /
Loosening

OPERATING MODE

Breaking => right joystick when tools selection is on “CRUST BREAKER”

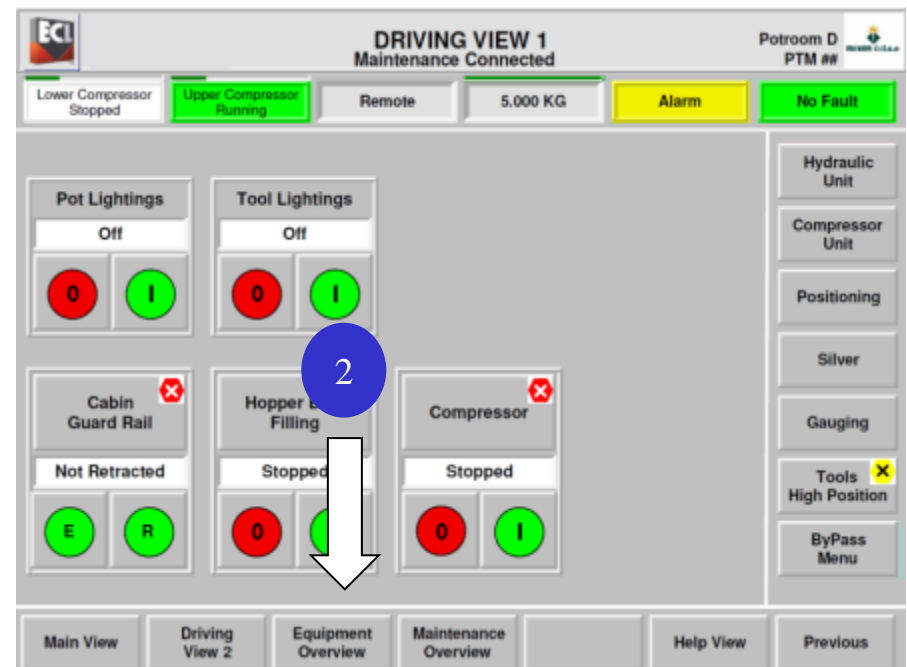
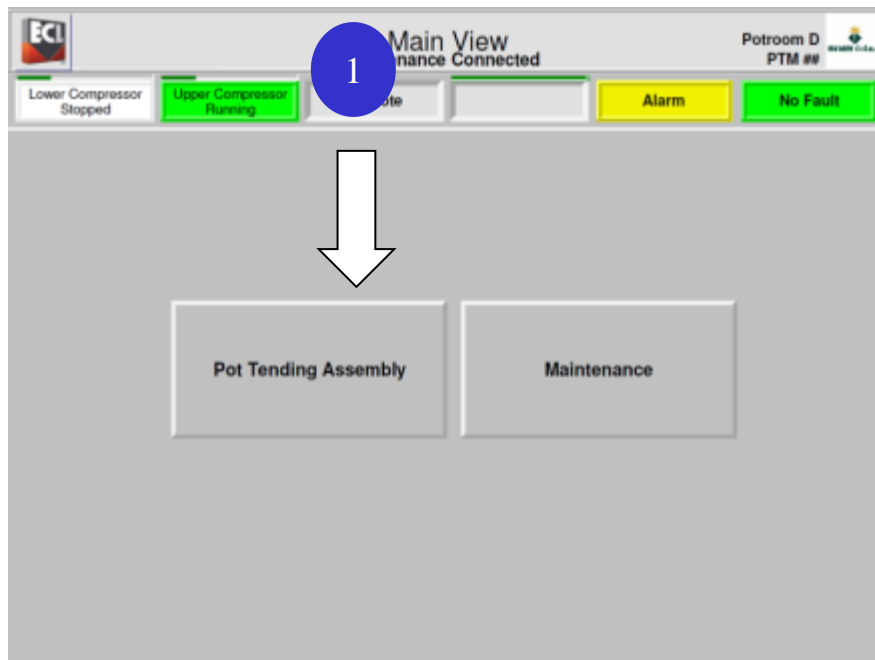
BREAKING

- Push the joystick forward for the lowering motion or pull the joystick backward for the raising motion.
- Press the left or right side toggle switch for breaker part lowering + breaking release it for stop breaking + breaker part raising.

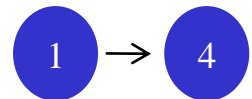


OPERATING MODE

Operating conditions – Crust breaker

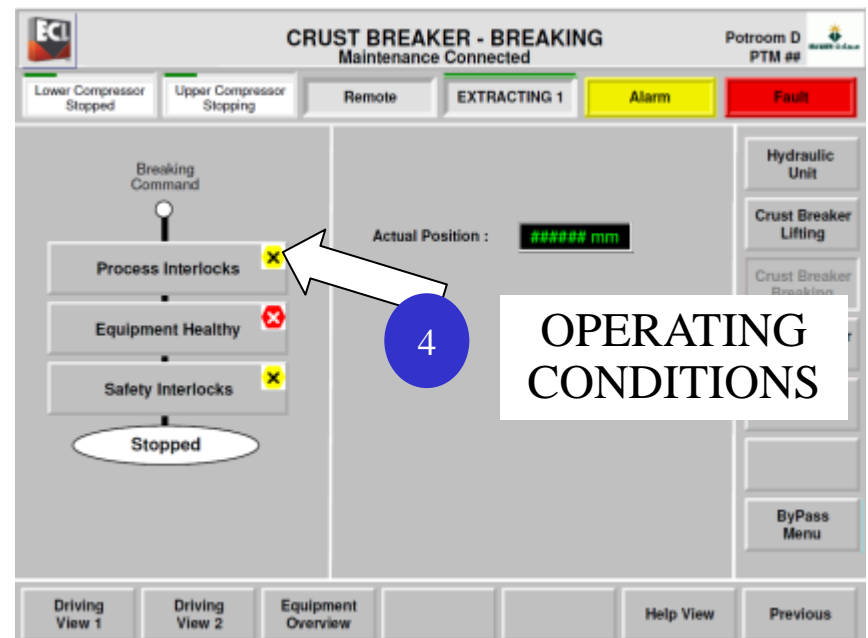
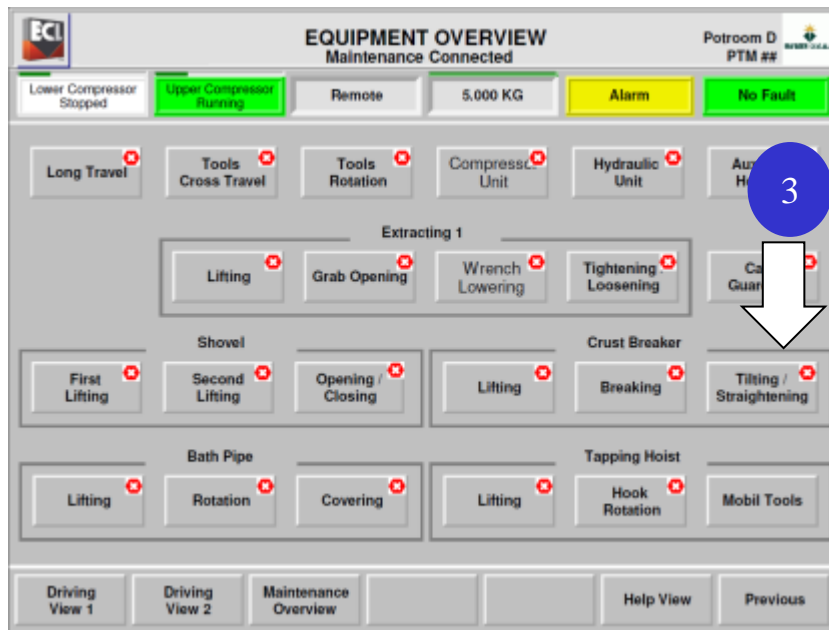


Realise the steps following



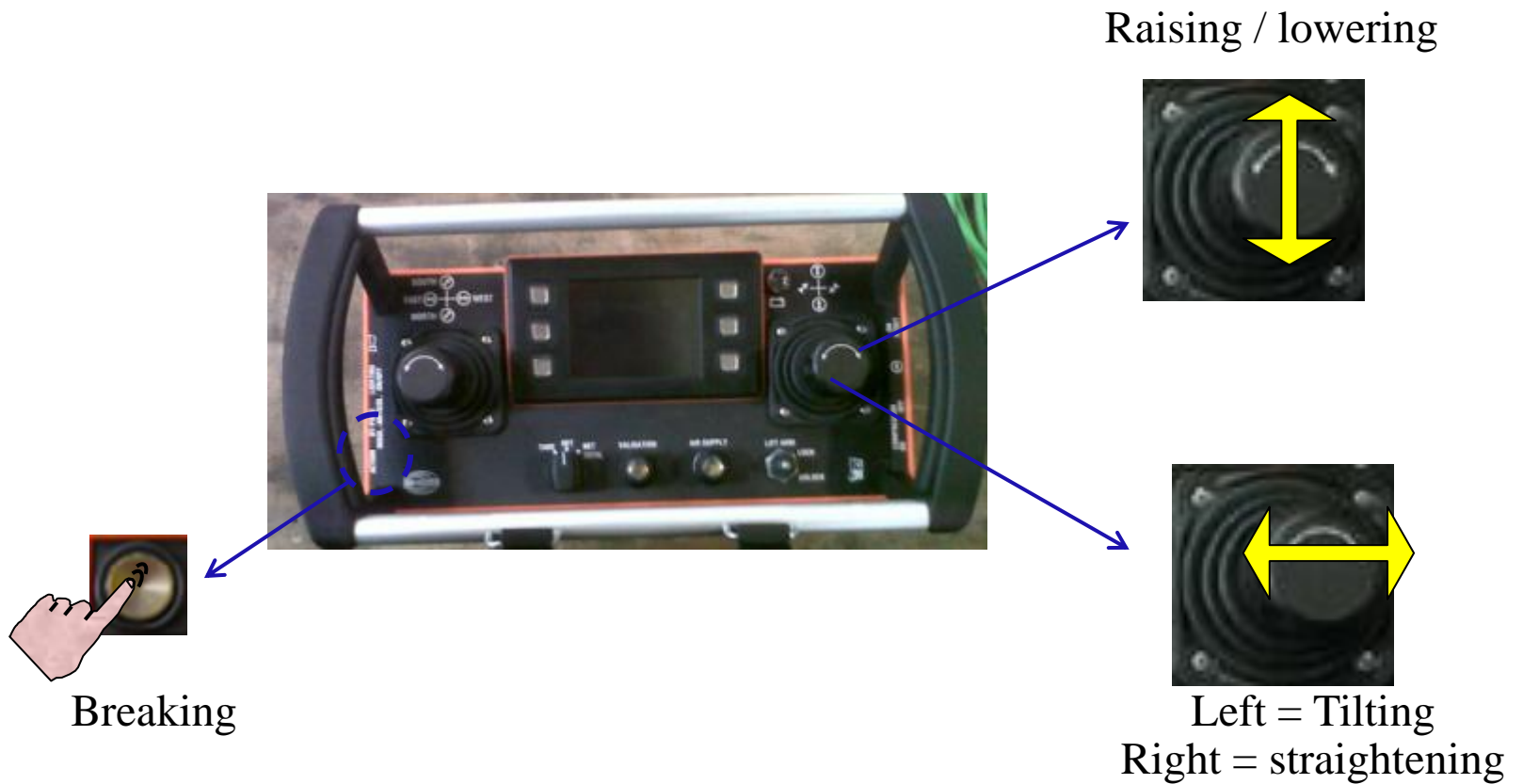
OPERATING MODE

operating conditions – Crust breaker



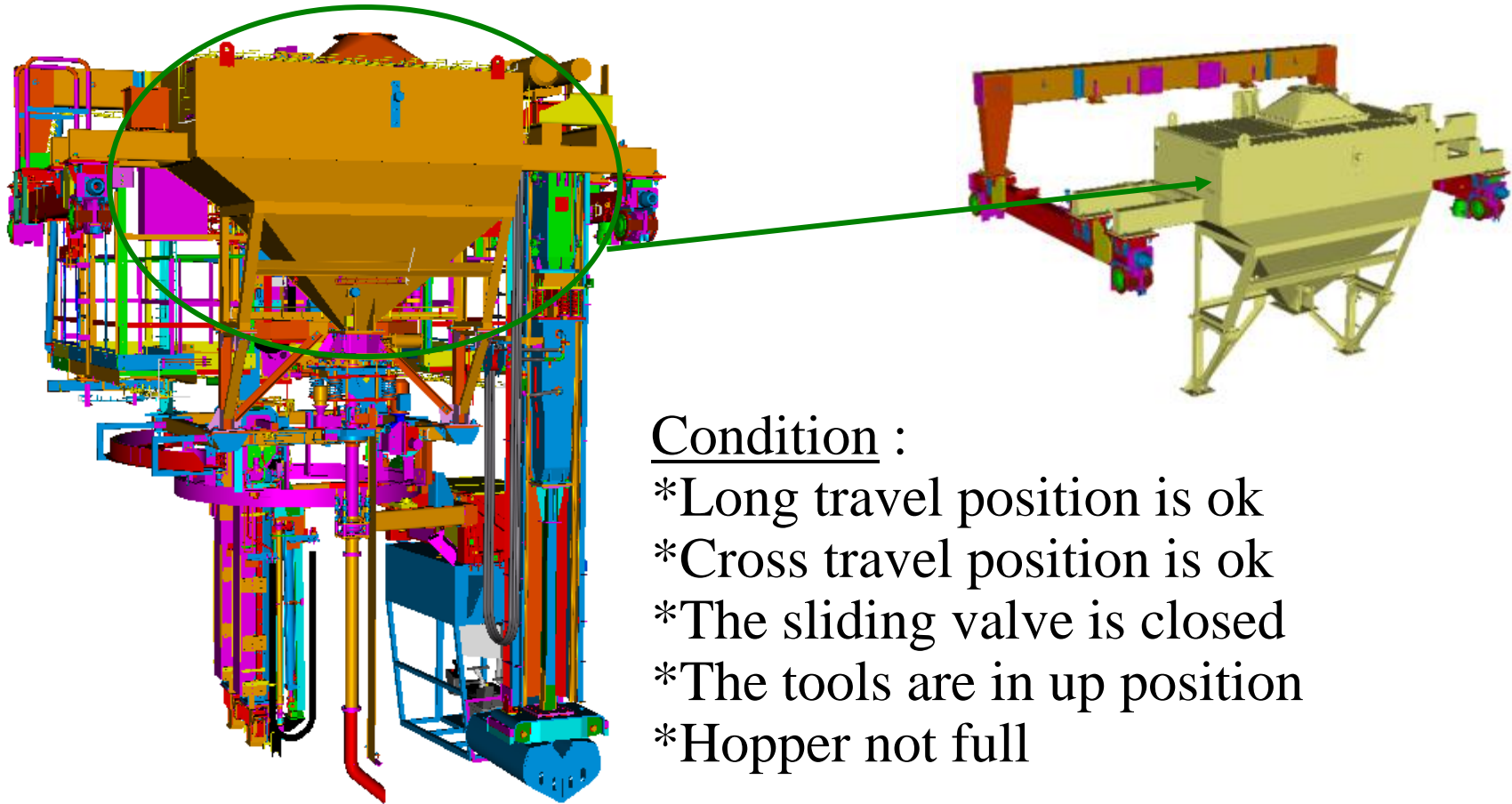
OPERATING MODE

Crust breaker



OPERATING MODE

HOPPER FILLING



Condition :

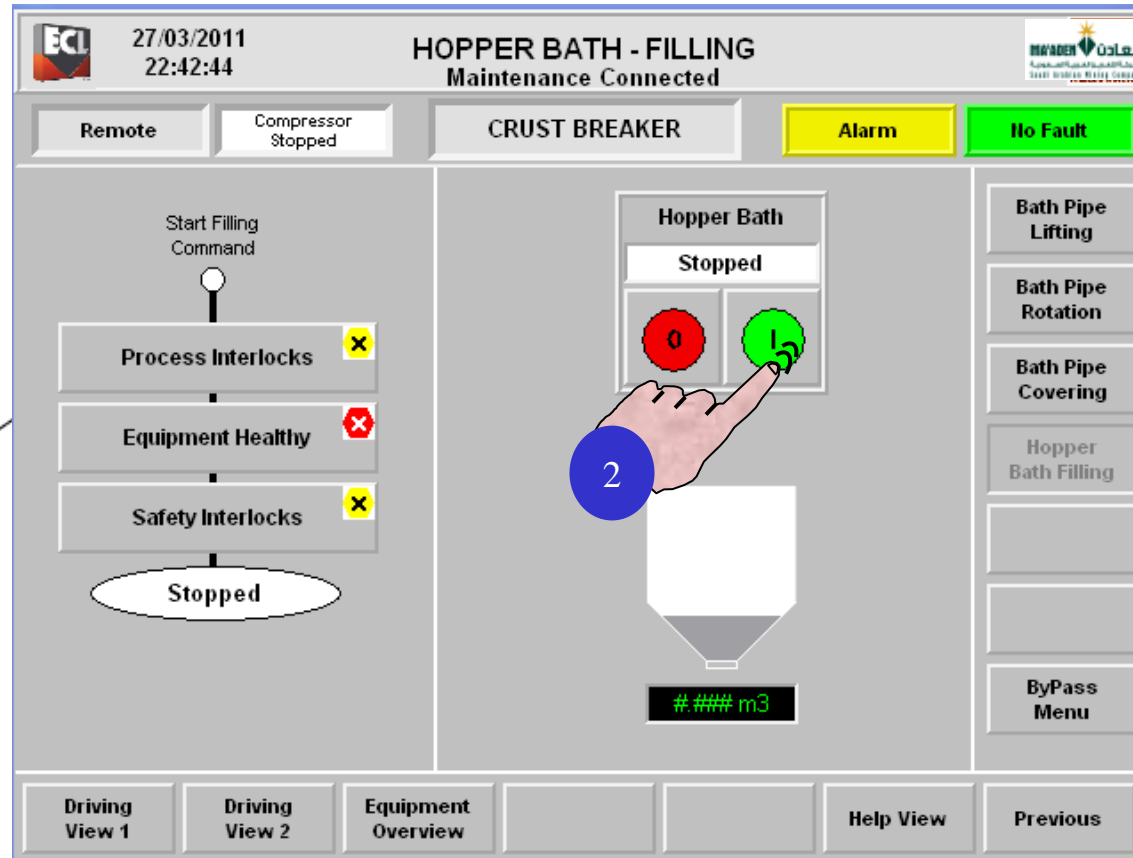
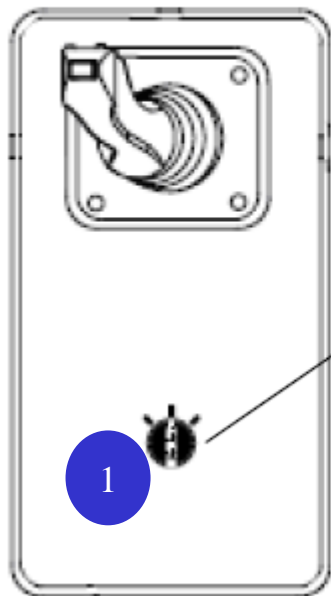
- *Long travel position is ok
- *Cross travel position is ok
- *The sliding valve is closed
- *The tools are in up position
- *Hopper not full

OPERATING MODE

RIGHT PULPIT

2

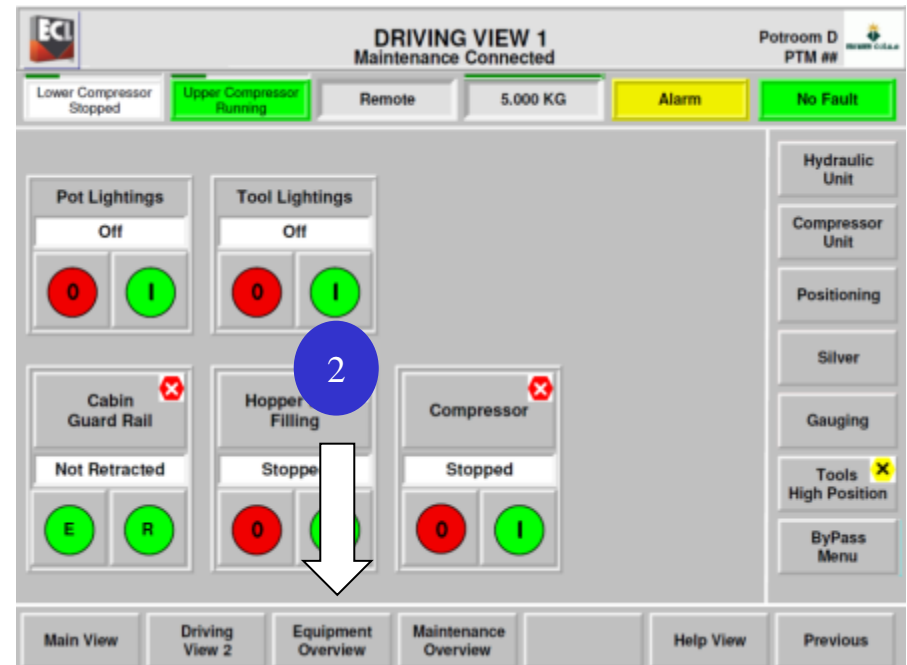
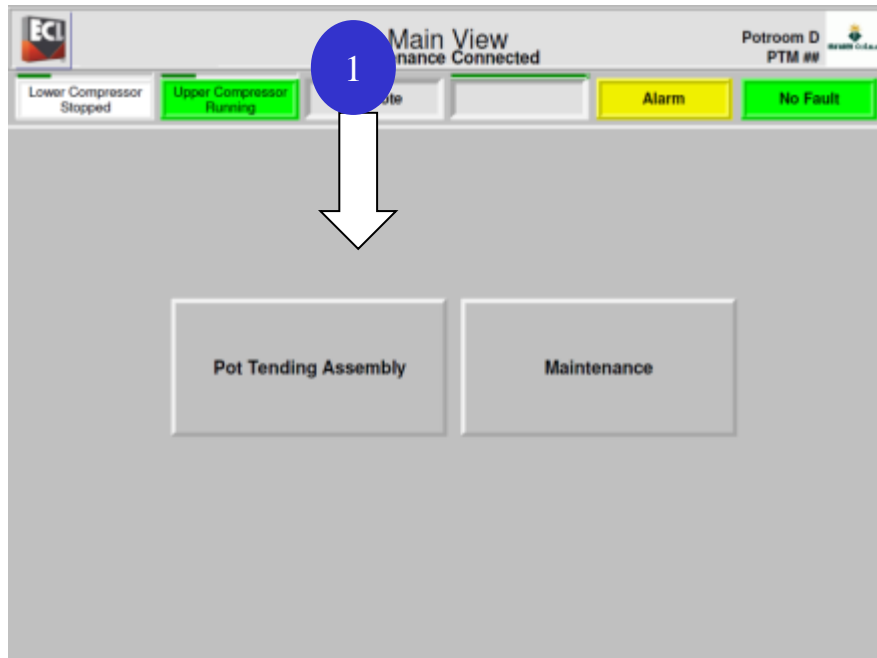
Good position for :
LT & CT



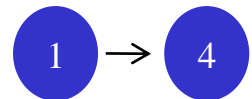
During the filling cycle and for one additional minute, the Pot Tending Machine cannot move (long travel, tools trolley cross travel and tools rotation).

OPERATING MODE

operating conditions - Hopper filling

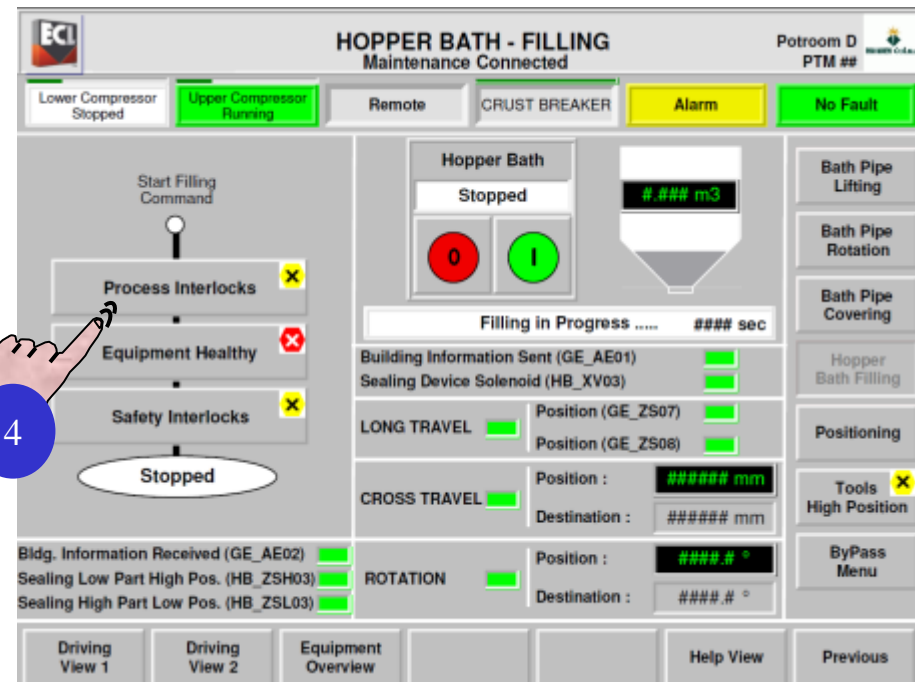
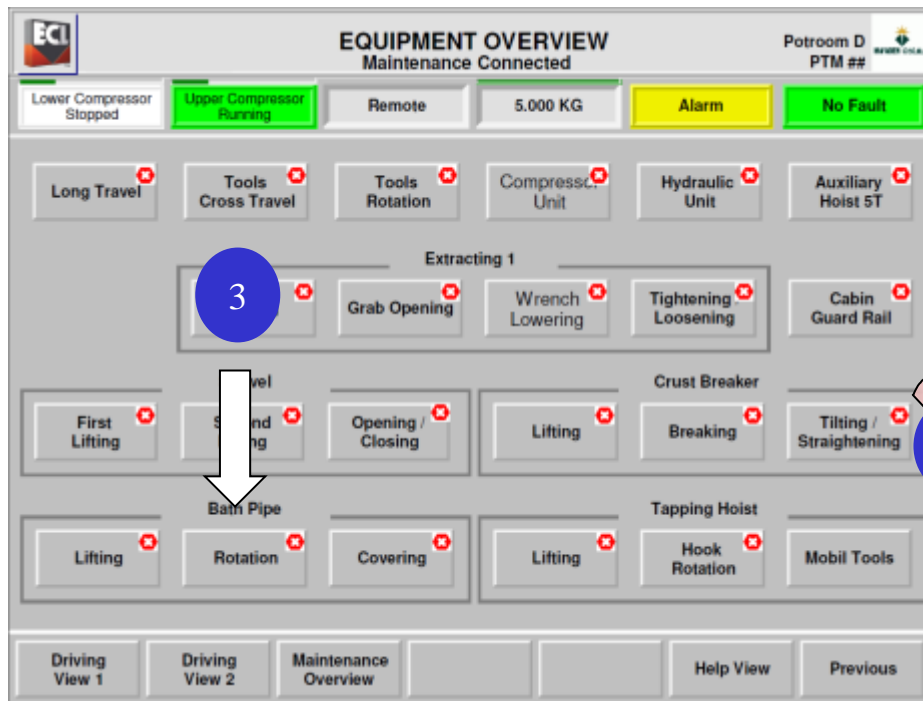


Realise the steps following

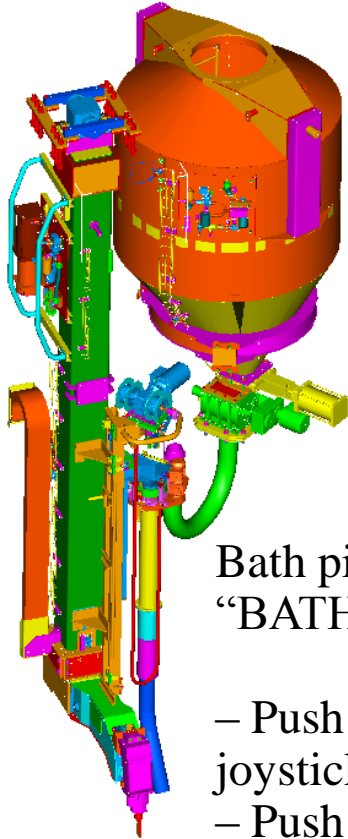


OPERATING MODE

operating conditions - Hopper filling



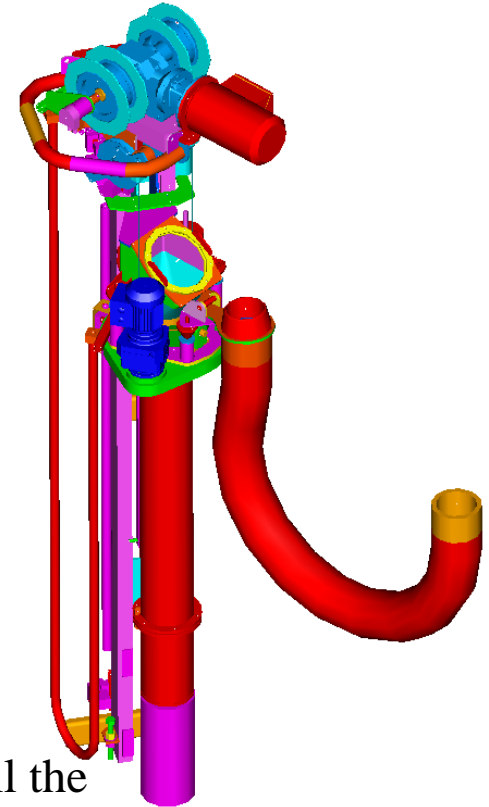
OPERATING MODE



BATH PIPE

Bath pipe => right joystick when tools selection is on “BATH PIPE”.

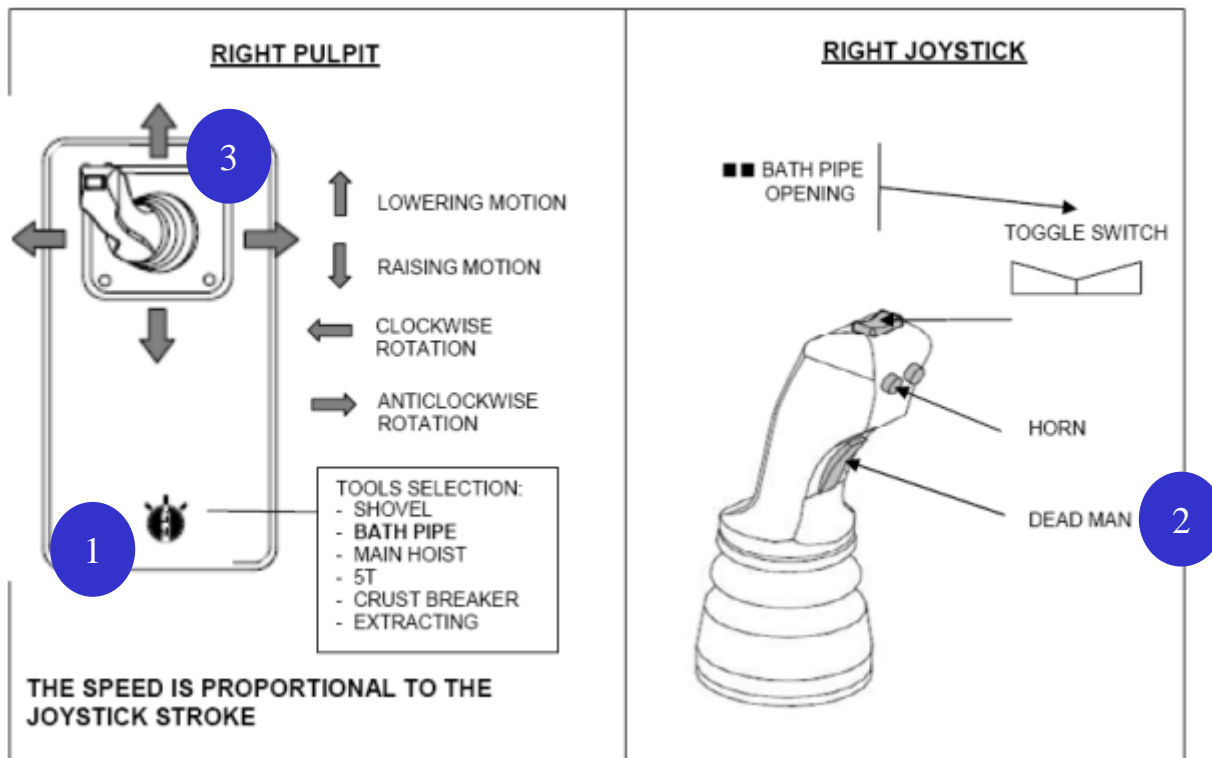
- Push the joystick forward for the lowering motion or pull the joystick backward for the raising motion.
- Push the joystick to the right for clockwise the pipe or push the joystick to the left for anticlockwise the pipe.
- Push the toggle switch located on top of the right joystick for opening (release for closing) the valve



OPERATING MODE

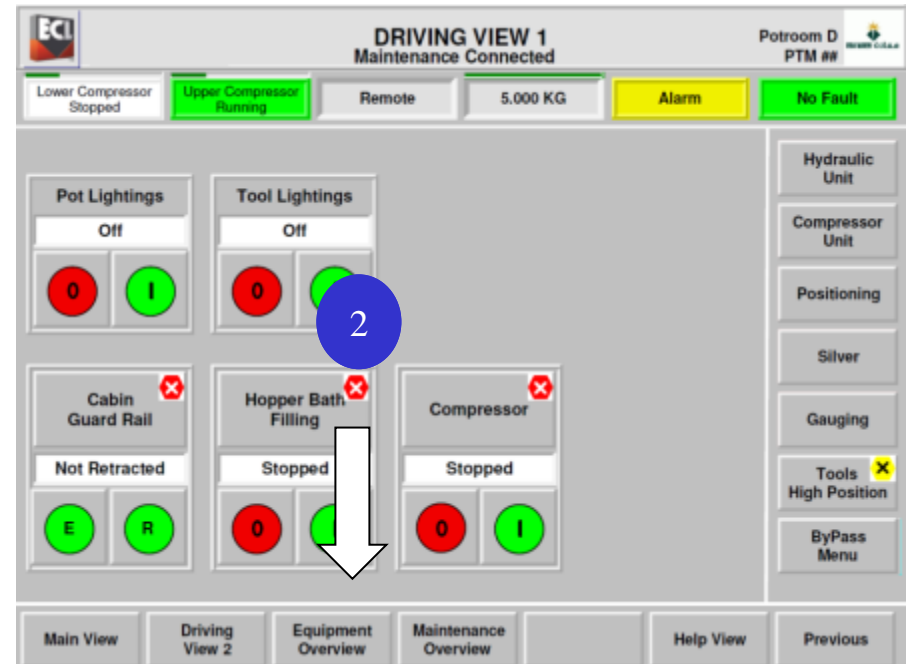
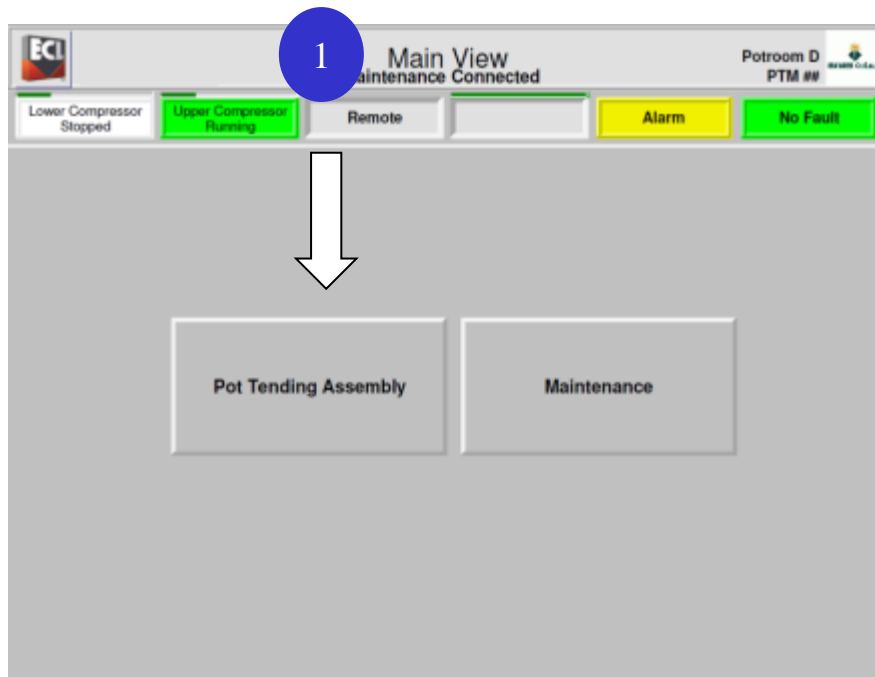
BATH PIPE

Follow the steps

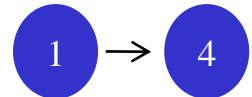


OPERATING MODE

operating conditions – Bath pipe

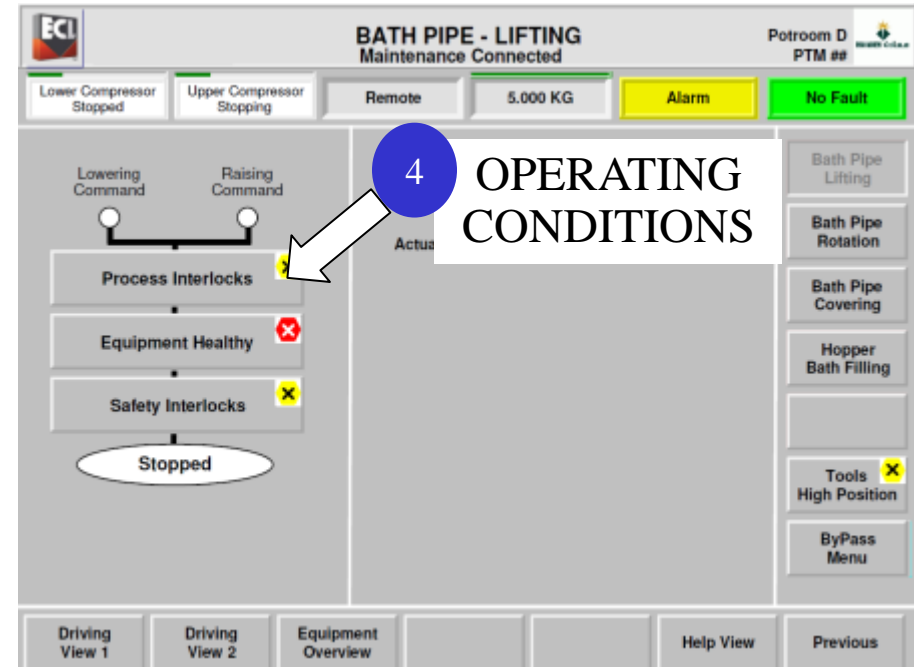
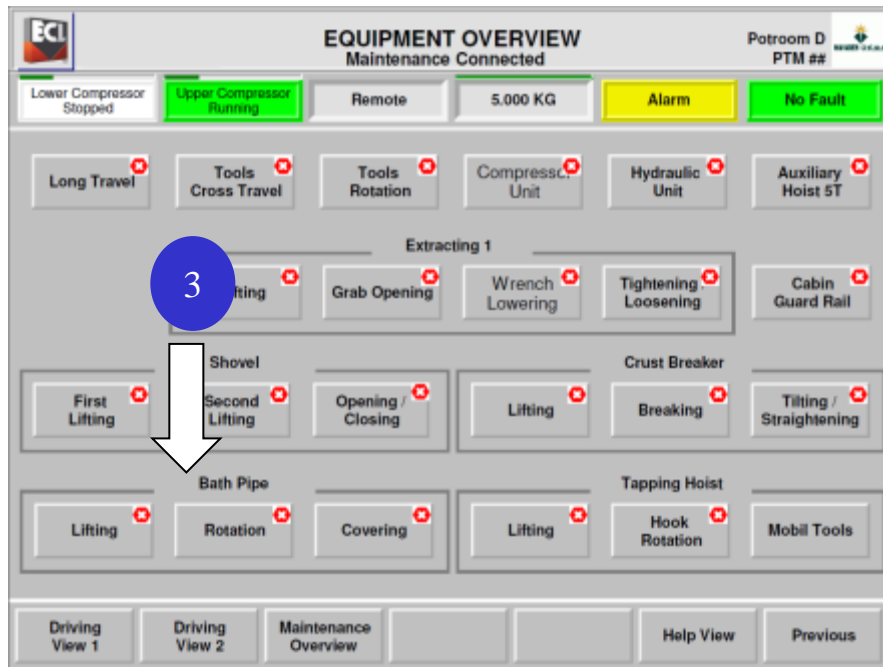


Realise the steps following



OPERATING MODE

operating conditions – Bath pipe



OPERATING MODE

Bath pipe



Rotation



Left = clockwise
Right = anti-clockwise



Push = opening
Release = closing

Raising / lowering

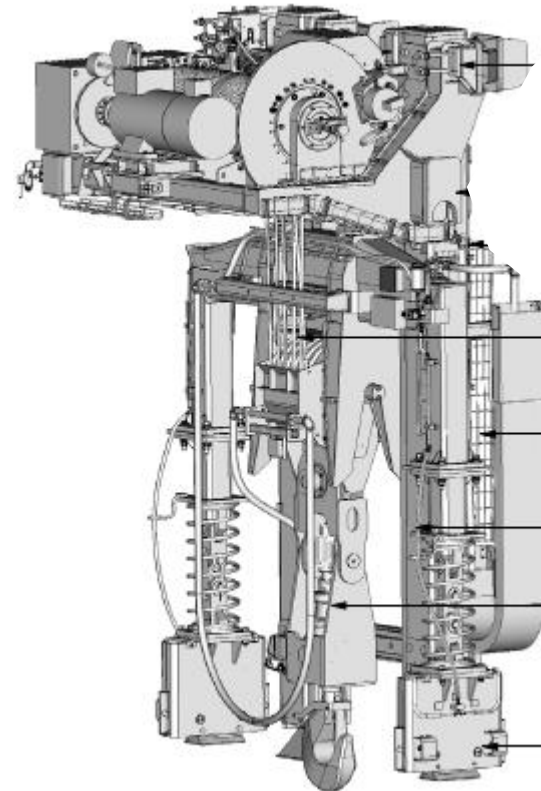
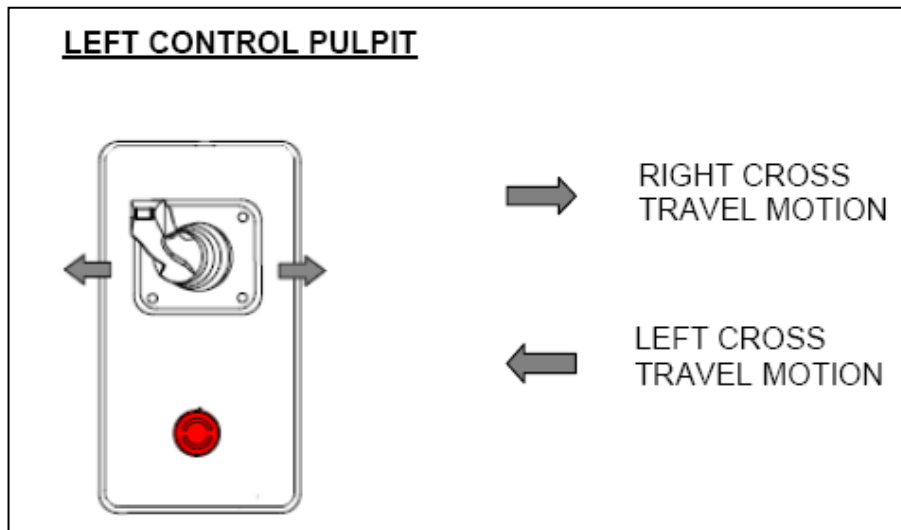


OPERATING MODE

TAPPING TROLLEY

Cross travel

- ✓ To inform of the machine displacement, the operator can actuate the horn by pressing on the push-button located on the right joystick.
- ✓ To stop the motion, bring the joystick handle in neutral position



OPERATING MODE

Hoisting + hook rotation=> right joystick when tools selection is on “MAIN HOIST”.



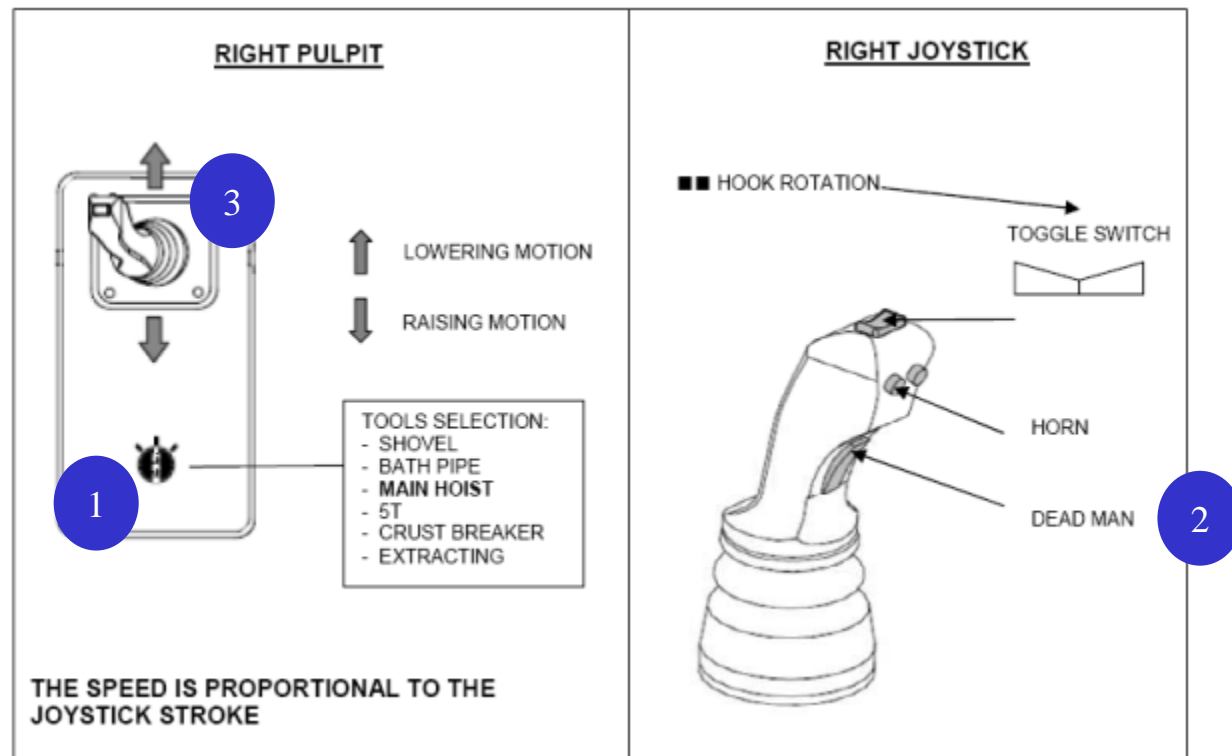
HOISTING MOTION

- Push the joystick for the hoisting lowering motion or pull the joystick for the hoisting raising motion.
- To stop the motion, bring the joystick handle in neutral position.

HOOK ROTATION MOTION

- Push on the toggle switch located on top of the right joystick for the hook rotation

OPERATING MODE



OPERATING MODE

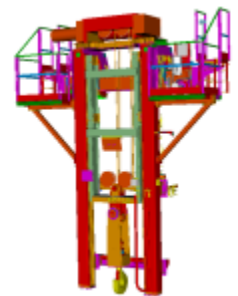
SECURITY

The hoisting over-travel disconnects the hoisting in case of selector default. To unlock hoisting over-travel, the maintenance operator must push on an “over travel bypass” push button on the hoist panel.

An overload system forbids the raising if there is an overload.
One under-load system, on the hook, stops the lowering.

The safety brake blocks the hoisting gear in case of :

- over-speed,
- over-travel,
- emergency stop



OPERATING MODE

Tapping



Hook Rotation



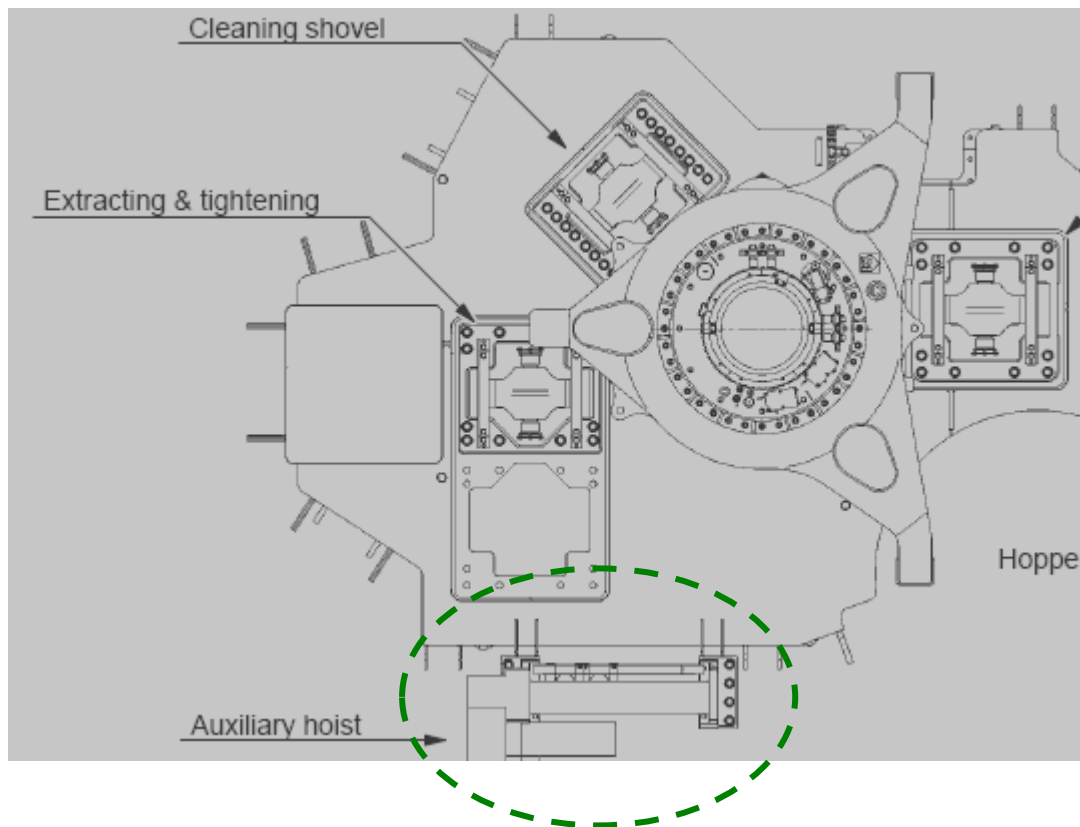
Left = clockwise
Right = anti-clockwise

Raising / lowering



OPERATING MODE

AUXILIARY HOIST (5T)



OPERATING MODE

Auxiliary hoist cross travel & hoisting motion => right joystick + tools selection “5T”.

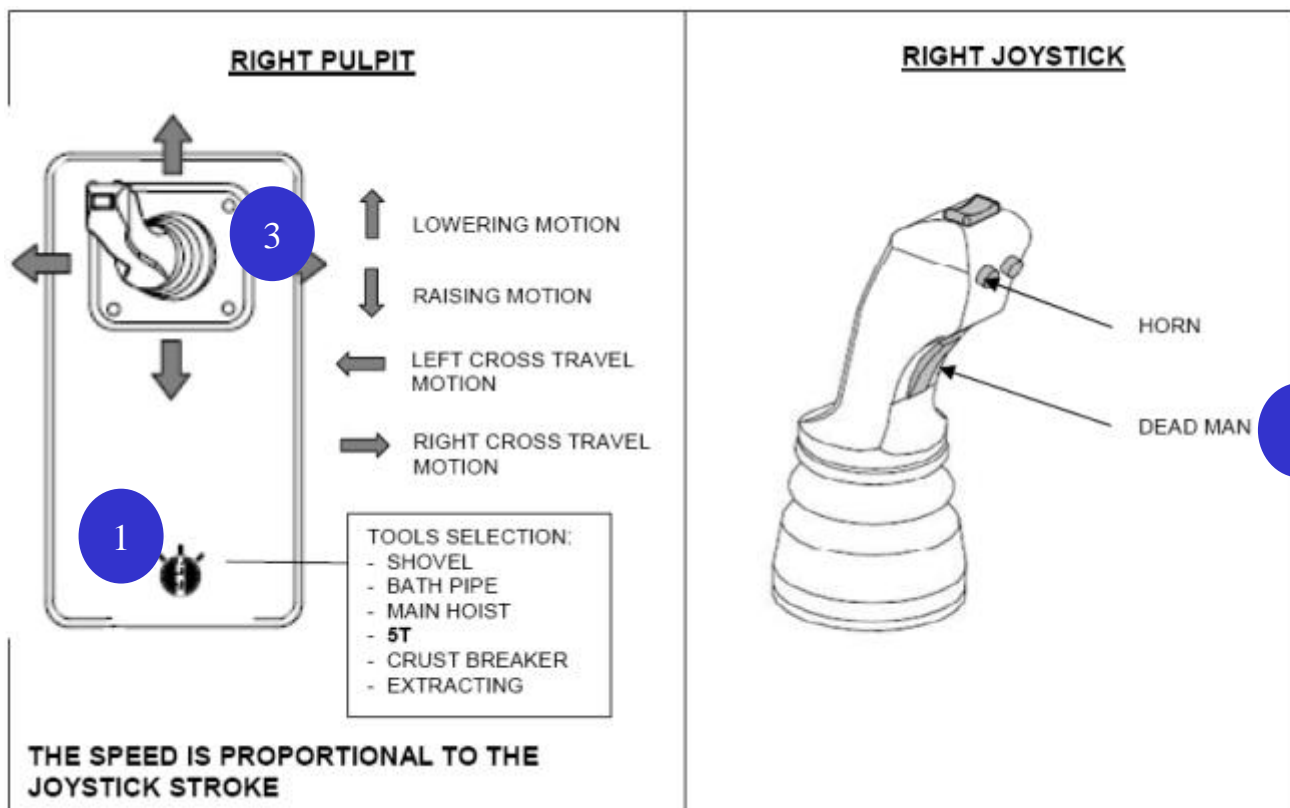
CROSS TRAVEL

- Push the joystick towards the right for the right cross travel motion
Or
- push the joystick towards the left for the left cross travel motion.
- To inform of the machine displacement, the operator can actuate the horn by pressing on the left push-button located on front of the right joystick.
- To stop the motion, bring the joystick handle in neutral position.

HOISTING

- Push the joystick for the hoisting lowering motion or pull the joystick for the hoisting raising motion.
- To stop the motion, bring the joystick handle in neutral position

OPERATING MODE

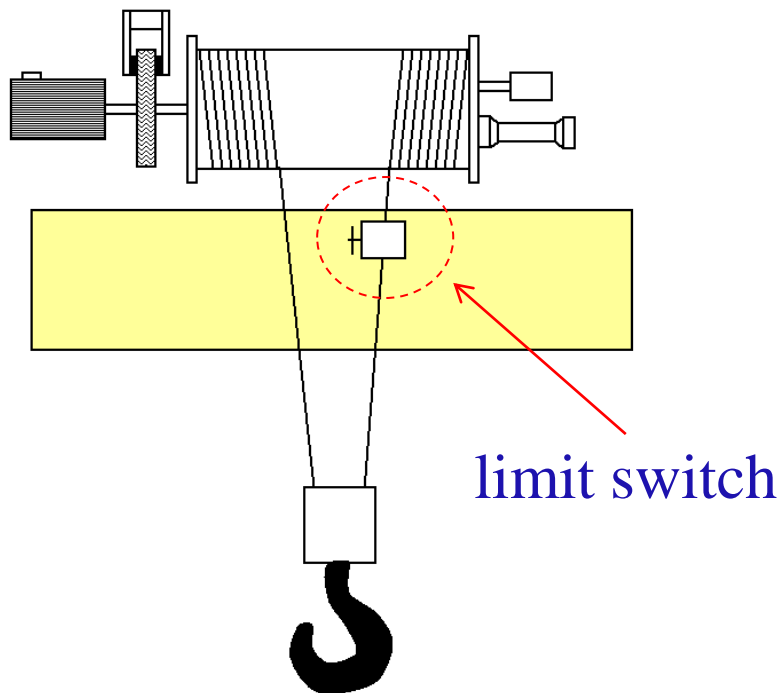


OPERATING MODE

Remember

OVERSTROKE

In case of over travel of high position
(defective high limit switch), the raising
motion will be
stopped and the lowering will be
forbidden, you are in OVERSTROKE



OPERATING MODE

Anode changing

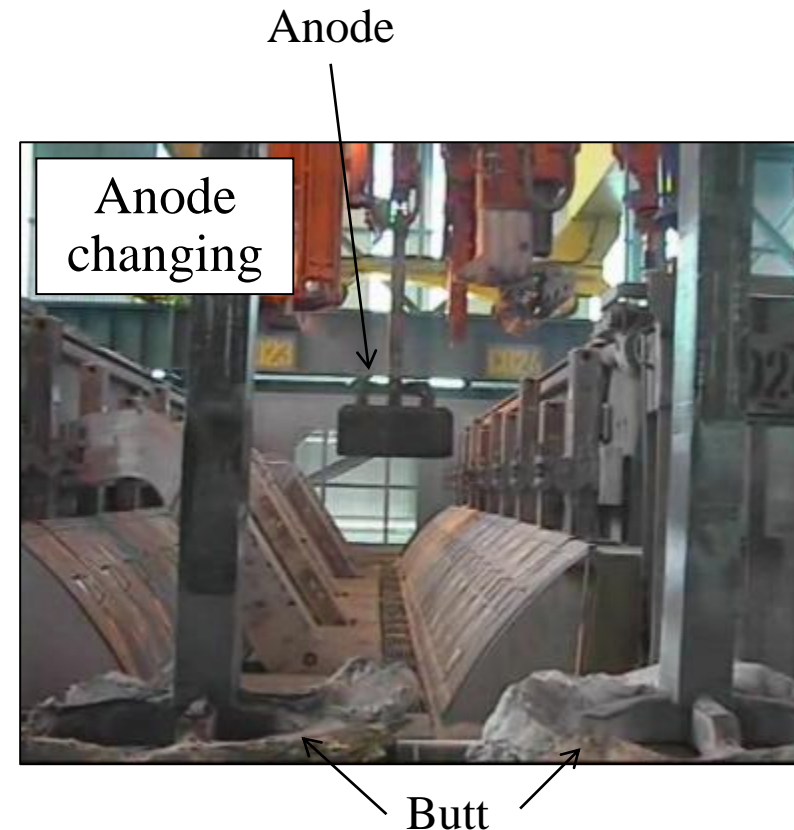
SEMI AUTOMATIC

Step 1: Extracting butt in the pot

Step 2: Take of dimension of butt on the base plan

Step 3: Catch of dimension of butt on the base plan

Step 4: Put the new anode in the pot

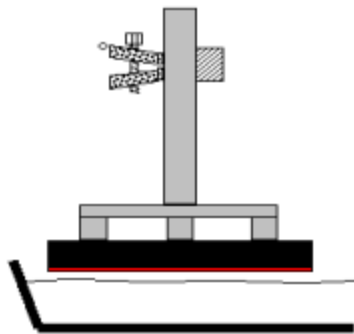


OPERATING MODE

Anode changing

1

Used anode in pot

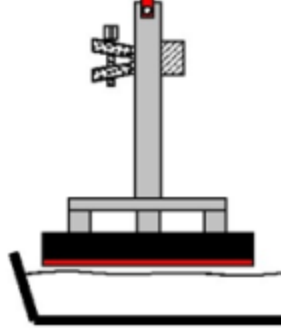


2

1 st measurement
Used anode in pot

1 st measurement
Used anode in pot

Measurement



3

Automatic validation step 1

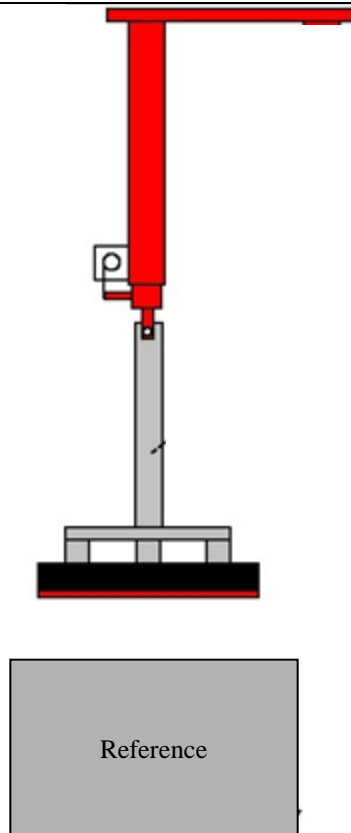
- The operator take the used anode and press the left toggle button of right joystick
- The extractors are going UP in tensioning speed & the measurements are recorded **automatically**
- When the tensioning is done, the operator order the slackening of the connector

Anode extractor positioning(x, y, z) & Clamp closed

OPERATING MODE

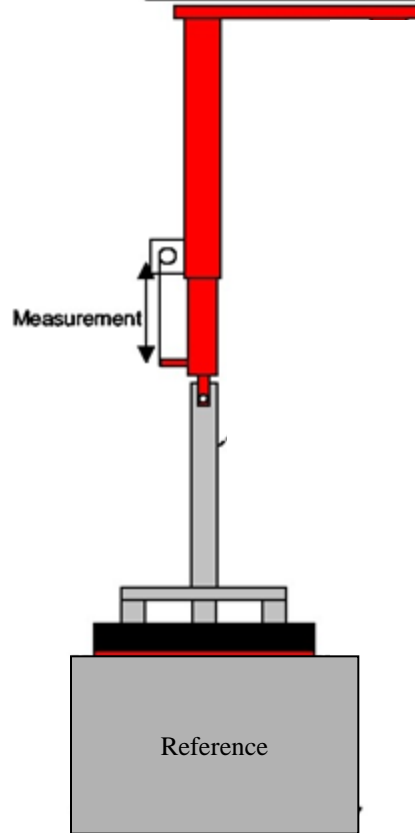
4

**Used anode above reference
Lowering the used anode**



5

**2 nd measurement
Used anode on reference**



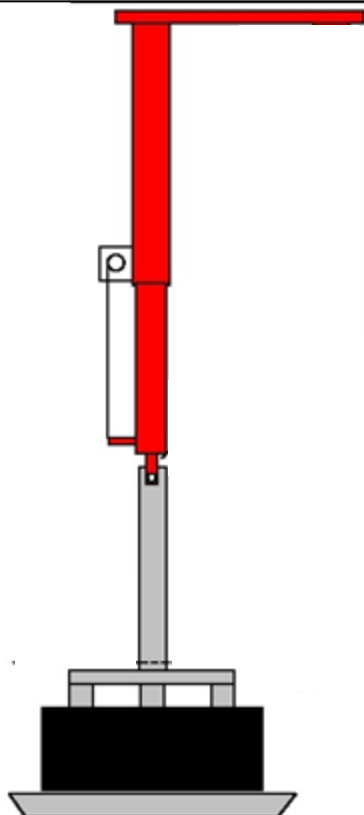
Operator validation step 2

- Before to lay down the used anode, the operator bring the used anodes above a reference plan and press the red button of right joystick.
- The extractors are going UP in tensioning speed & the 2 nd measurements are recorded **automatically**
- Then, the operator can lay down the used anode on palett

OPERATING MODE

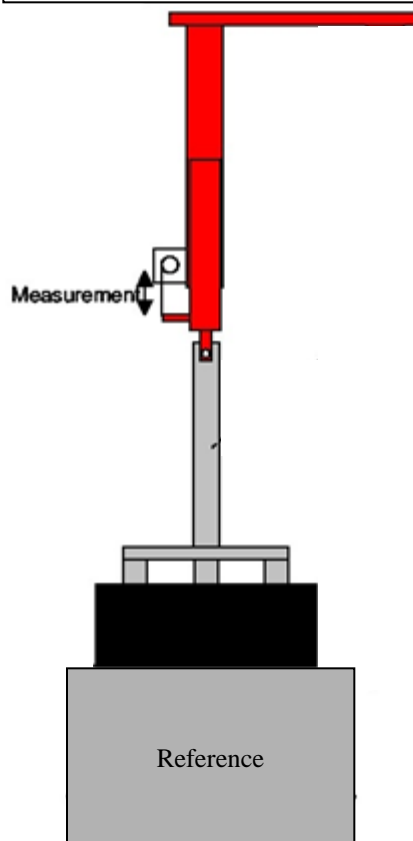
6

**New anode above reference
Lowering the new anode**



7

**3 rd measurement
New anode on reference**



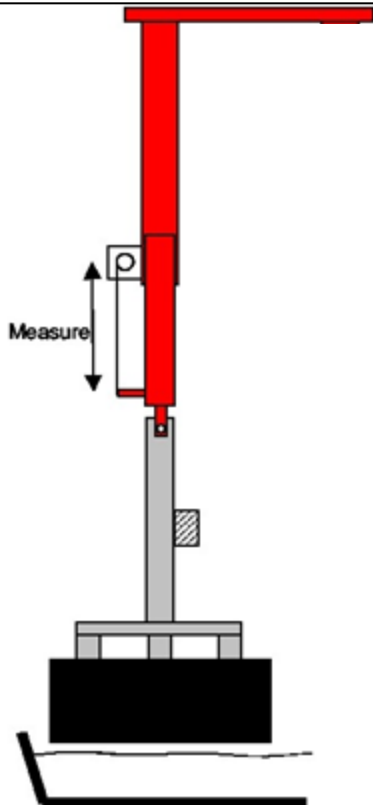
Operator validation step 3

- The operator take the new anodes
- The operator put the new anode on the reference plan and press the red button of right joystick.
- The extractors are going UP in tensioning speed & the 3 rd measurements are recorded **automatically**
- Then, the operator can move the new anode to the pot

OPERATING MODE

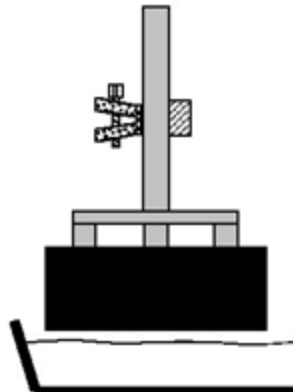
8

**Replace new anode in pot
Set automatically new anode**



9

New anode in pot



Operator validation step 4

- The operator put the new anodes in position (X & Y)
- The operator press the red button of right joystick.
- The new anodes goes down & UP automatically to set the levelling of the new anodes.
- The operator can lower the connectors and tighten them.

NOTA: At each moment of the automatics cycles (cycle of measurement) the operator could stop and restart the cycles through the operator interface or joystick.

OPERATING MODE

The value dimension new anode in the tank is equal:

NEW DIMENSION IN THE POT = DIMENSION 1 - DIMENSION 2 + DIMENSION 3 - X mm

Value dimension
anode used in
tank

Dimension of the
anode used on base
plan

Dimension of the
anode used on base
plan

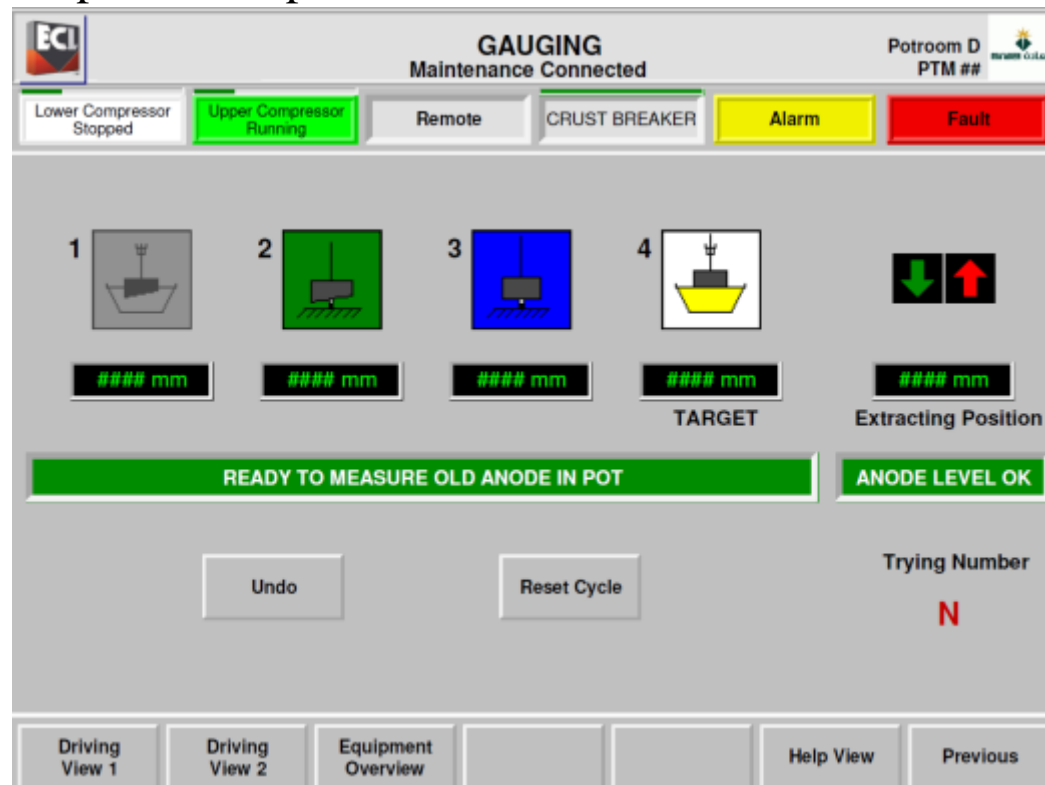
Coefficient cold
anode
compensation

OPERATING MODE

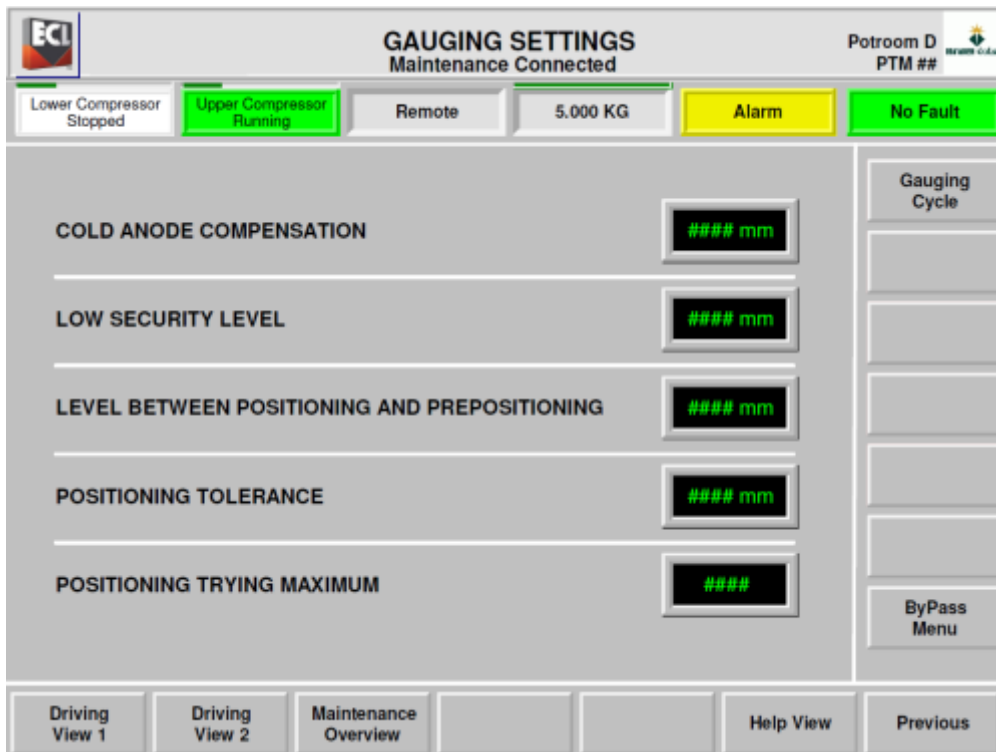
Operating cycle

The operator can use the gauging from the cab.

The operator can follow the cycle on gauging screen and see the steps in progress (white) and the steps validate (green) At any time, he can restart all steps of measurement by pushing on the icons steps on the operator terminal.



OPERATING MODE



The screenshot shows the 'GAUGING SETTINGS' screen with 'Maintenance Connected'. The top status bar includes 'Potroom D PTM ##' and a small logo. Below this, there are several status indicators: 'Lower Compressor Stopped', 'Upper Compressor Running' (highlighted in green), 'Remote', '5.000 KG', 'Alarm' (highlighted in yellow), and 'No Fault' (highlighted in green). The main area contains five settings, each with a value field showing '#### mm': 'COLD ANODE COMPENSATION', 'LOW SECURITY LEVEL', 'LEVEL BETWEEN POSITIONING AND PREPOSITIONING', 'POSITIONING TOLERANCE', and 'POSITIONING TRYING MAXIMUM'. To the right of these settings is a vertical stack of buttons: 'Gauging Cycle', four empty buttons, and 'ByPass Menu'. At the bottom, there are navigation buttons: 'Driving View 1', 'Driving View 2', 'Maintenance Overview', two empty buttons, 'Help View', and 'Previous'.

Manual mode

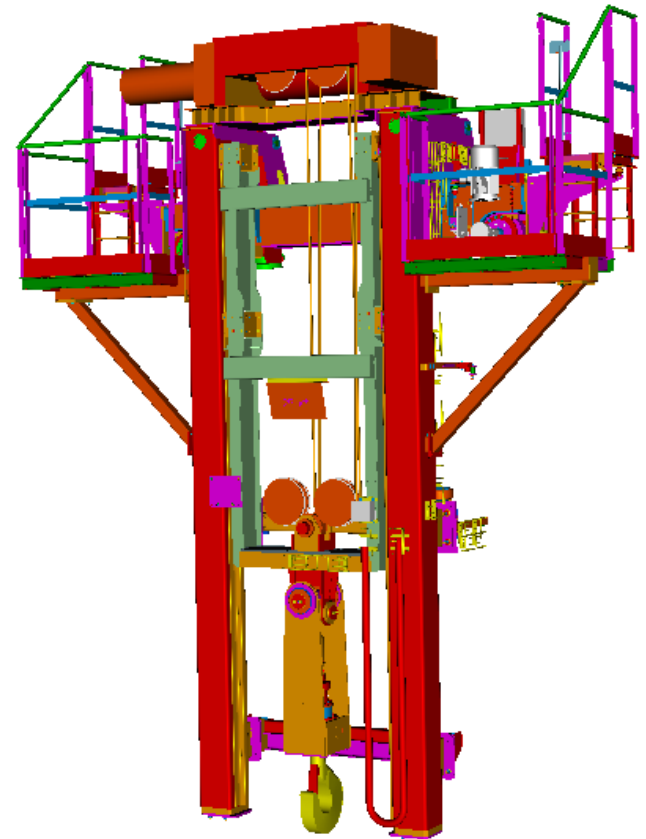
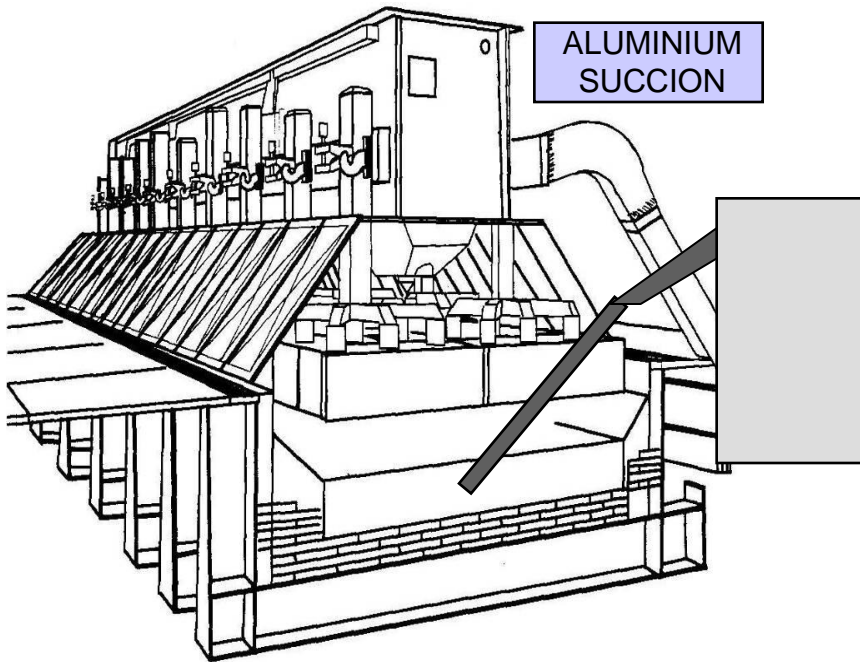
- The automatic positioning of the anodes fails more than three times
- The low level security is reached (prevent the risk of short-circuit between the bus bar and the pot)
- An encoder error is detected

OPERATING MODE

Tapping metal pot n° 2

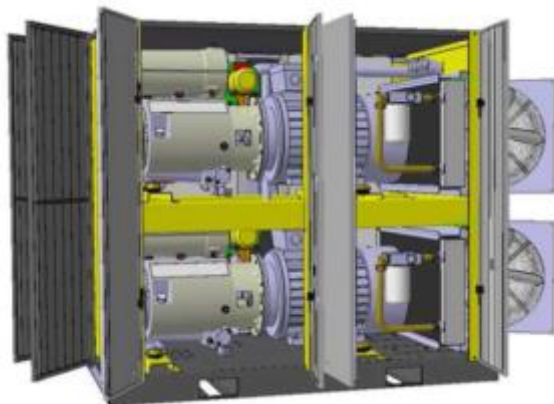
Tapping metal pot n°

ALUMINIUM
SUCCION



OPERATING MODE

Tapping



You must start the second compressor for the tapping operation

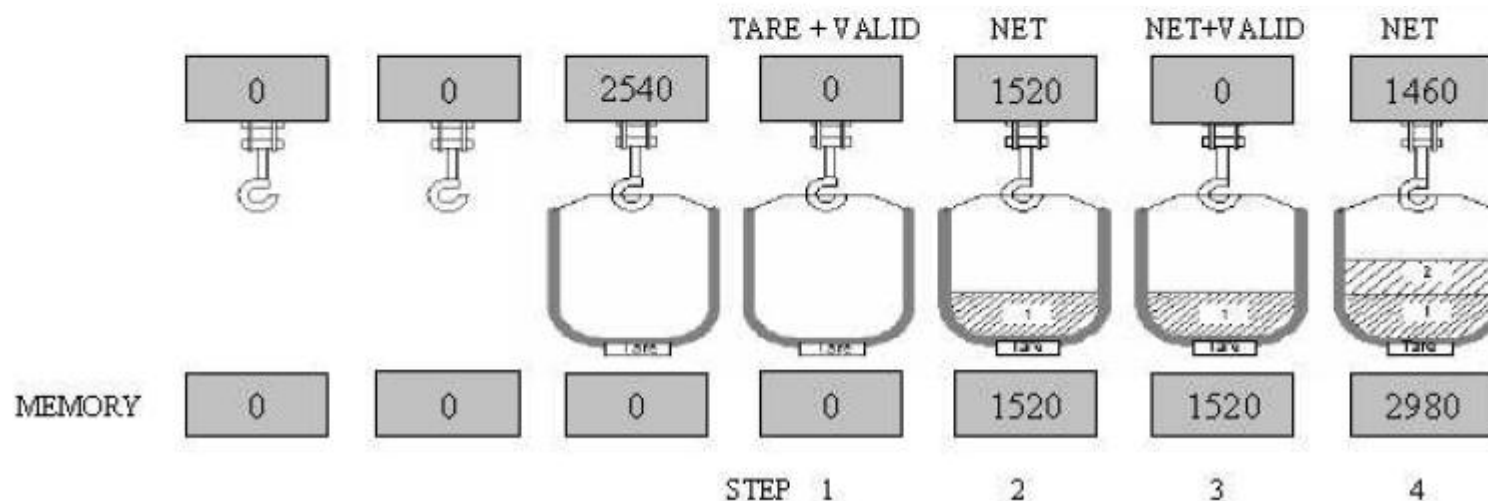


During the tapping operation, the long travel and the cross travel motions are forbidden
 When an overload is detected, the raising motion stopped, the lowering motion is enable in low speed
 When an underload is detected, the lowering motion stopped, the raising motion is enable in low speed

OPERATING MODE

From Remote Radio Box

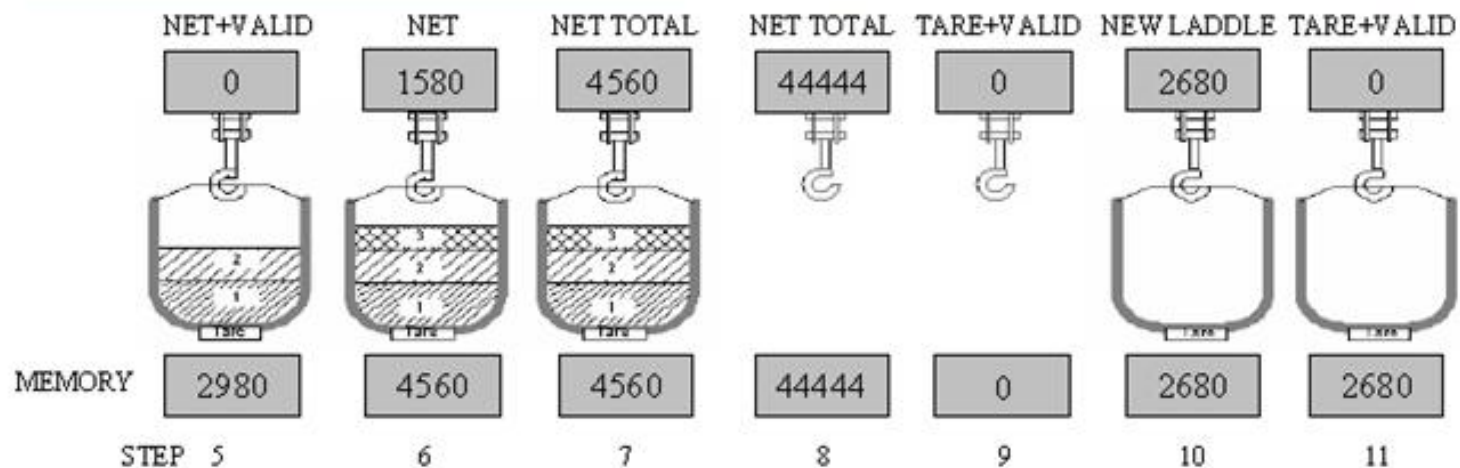
- 1- Select TARE and press validation to display 0 with empty laddle
- 2 - Select NET to record the actual material weight (1st Tapping)
- 3 - Select NET and press validation to display 0 and memorize the actual material weight
- 4 - Select NET to record the actual material weight (2nd Tapping)



OPERATING MODE

From Remote Radio Box

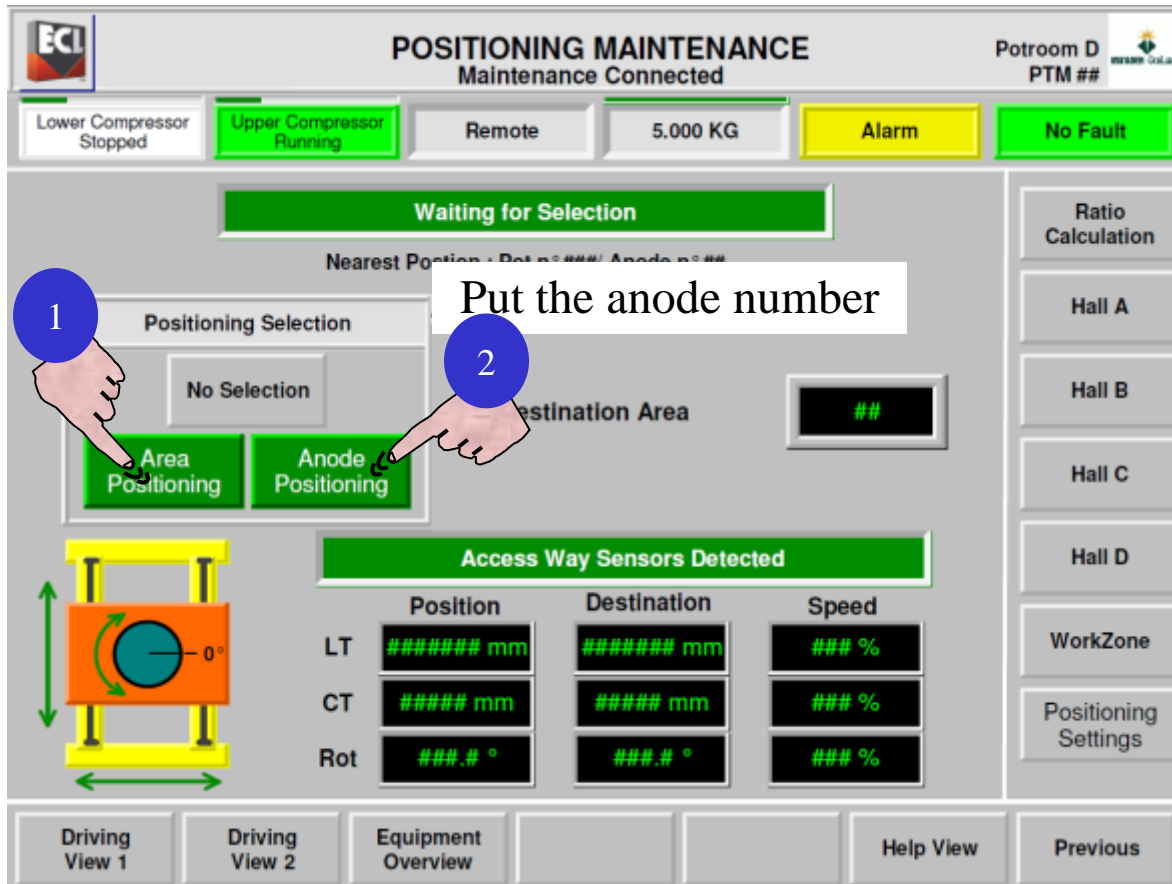
- 5- Select NET and press validation to display 0 and memorize the material weight (Tapping 1 & 2)
- 6 - Select NET to record the actual material weight (3rd Tapping)
- 7 - Select NET TOTAL to display the total material weight (Tapping 1+2+3)
- 9 - Select TARE + validation to reset memory and display 0
- 10 - Start new cycle



OPERATING MODE

Automatic position

Put the
pot number



POSITIONING MAINTENANCE
Maintenance Connected

Potroom D
PTM ##

Lower Compressor Stopped Upper Compressor Running Remote 5.000 KG Alarm No Fault

Waiting for Selection

Nearest Position: Pot ####/ Anode ####

Positioning Selection

No Selection

Area Positioning Anode Positioning

Destination Area ##

Access Way Sensors Detected

	Position	Destination	Speed
LT	##### mm	##### mm	### %
CT	##### mm	##### mm	### %
Rot	###.# °	###.# °	### %

Driving View 1 Driving View 2 Equipment Overview Help View Previous

Ratio Calculation

Hall A

Hall B

Hall C

Hall D

WorkZone

Positioning Settings

Put the anode number

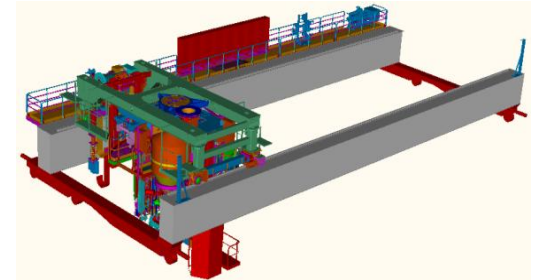
SUMMARY

1. HEALTH & SAFETY
2. TECHNICAL DATA
3. OPERATION DESCRIPTION
4. EQUIPMENT DESCRIPTION
5. OPERATING MODE

From cabin (PTA)

From Remote control box (Floor)

6. ALARM & FAULT





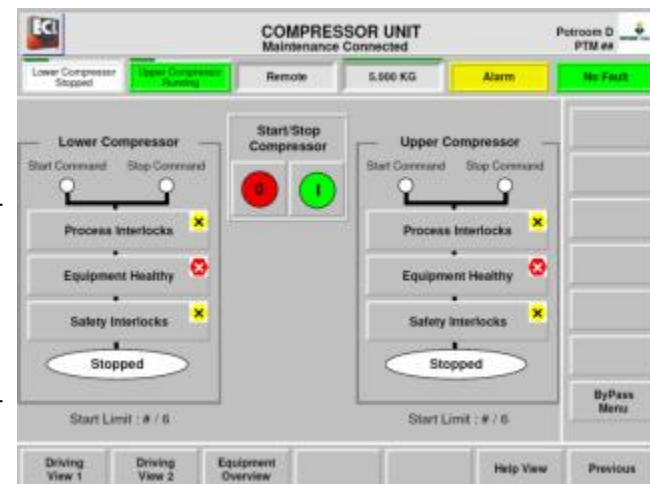
Interlocks pages

Crust Breaker not in High Position	
Crust Breaker Tilting not in High Position	
Extracting 1 not in High Position	
Shovel First Lifting not in High Position	
Shovel Second Lifting not in High Position	
Bath Pipe not in High Position	
Tapping not in High Position	
5T not in High Position	

West Main Girder Access Requested	
East Main Girder Access Requested	
North West Tools Trolley Access Requested	
South West Tools Trolley Access Requested	
North East Tools Trolley Access Requested	
South East Tools Trolley Access Requested	
Cab Access Requested	

Exit

Exit



ALARM & FAULT

FAULT

A fault is generally a failure that interrupts the process, or prevents start or re-start until rectified. Faults are recognized as either instantaneous or continuous.

Examples of instantaneous faults:

- A motor tripping on drive overload.
- A two way diverter failing to move from A to B.
- Failure to receive status or feedback signal.

Examples of continuous faults

- Device over temperature.
- Low system pressure.

All fault are displayed on operator interface by a fault banner (alarm panelview)

ALARM & FAULT



ALARM HISTORY
Maintenance Connected

Potroom D
PTM ##


Lower Compressor Starting

Upper Compressor Running

PTM Off

CRUST BREAKER

No Alarm

Fault

Alarm time	Acknowledge time	Message
07/08/2012 15:47:55*	07/08/2012 15:47:55*	ABCDE FGHIJK LMNOPQ RSTUV WXYZ ABCDE FGHIJK LMNOPQ RSTUV*

▲

▲▲

▼▼

▼

Driving View 1

Driving View 2

Equipment Overview

Help View

Previous

ALARM & FAULT

ALARM

An alarm is generally a condition or occurrence that needs to be brought to the attention of the operational personnel for rectification, but does not immediately prevent the operation of the plant. Alarm stops the process at the end of the cycle and prevents start or restart.

Examples

- • Operational limits, i.e. storage vessel level.
- • Functional status, i.e. sequence shutdown.

Non-operation of a device after a “grace time” period shall constitute a fault and be alarmed separately for each device. This “grace time” shall be calibrated during commissioning and shall be easily modifiable thereafter. Example application shall be the time for a valve to move from one state (open) to another (closed), or the time for the “running” signal to be received from a motor starter after setting the “start motor” command.

ALARM & FAULT



FAULT HISTORY
 Maintenance Connected

Potroom D
 PTM ##



Lower Compressor
Starting

Upper Compressor
Running

PTM Off

CRUST BREAKER

No Alarm

Fault

Fault time	Acknowledge time	Message
07/08/2012 15:48:31*	07/08/2012 15:48:31*	ABCDE FGHIJK LMNOPQ RSTUV WXYZ ABCDE FGHIJK LMNOPQ RSTUV*

▲

▲▲

Fault Reset

▼▼

▼

Driving View 1

Driving View 2

Equipment Overview

Help View

Previous

ALARM & FAULT

EVENT

An event is generally a condition or occurrence that needs to be brought to the attention of the operational personnel for rectification, but does not immediately prevent the operation of the plant. An event will never block the process or cycle running



<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

**THANK YOU FOR YOUR
ATTENTION**

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

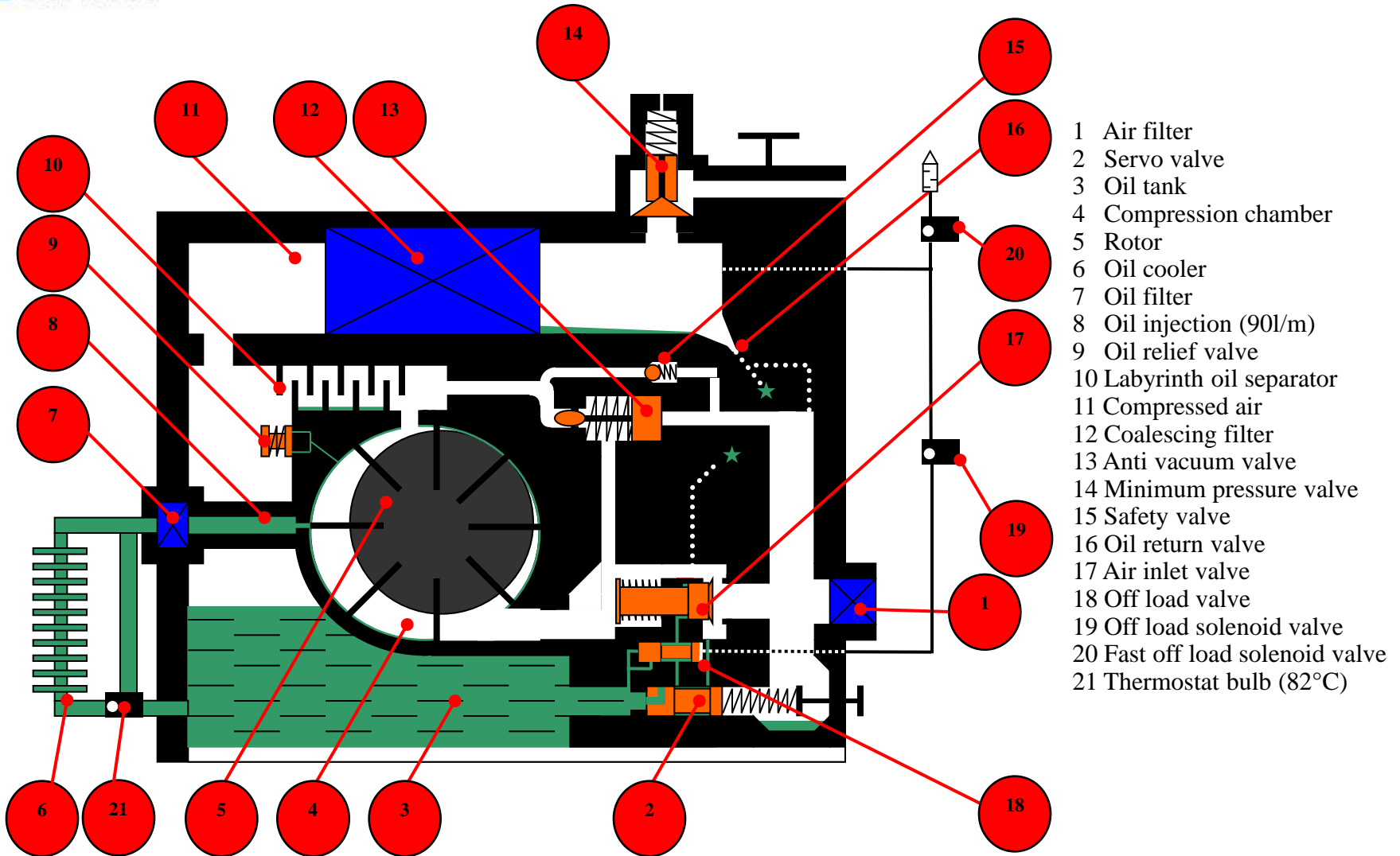
MA'ADEN PROJECT

P1034 - PTM

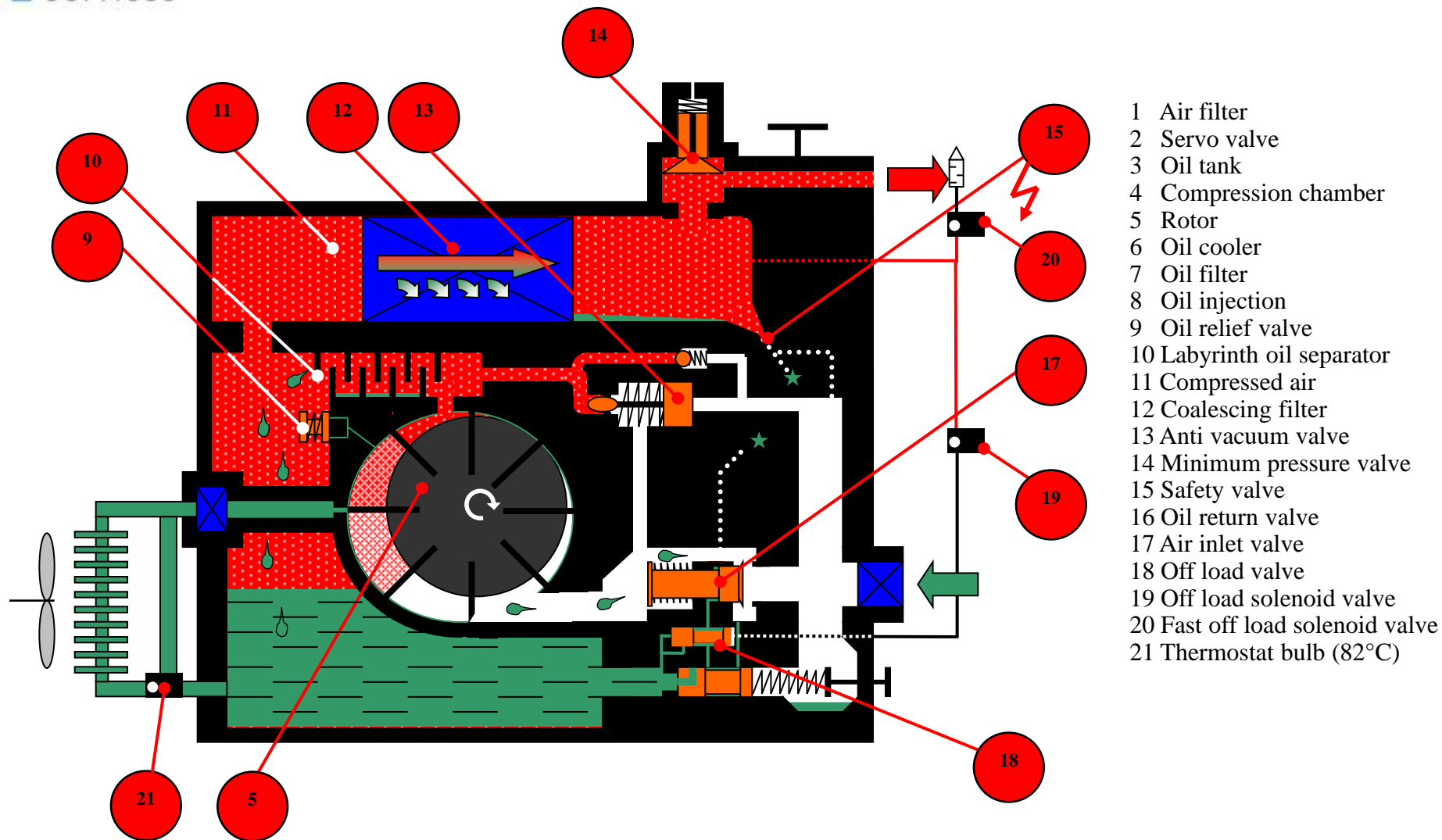
POT TENDING MACHINE

Compressor MS 880 L ECL

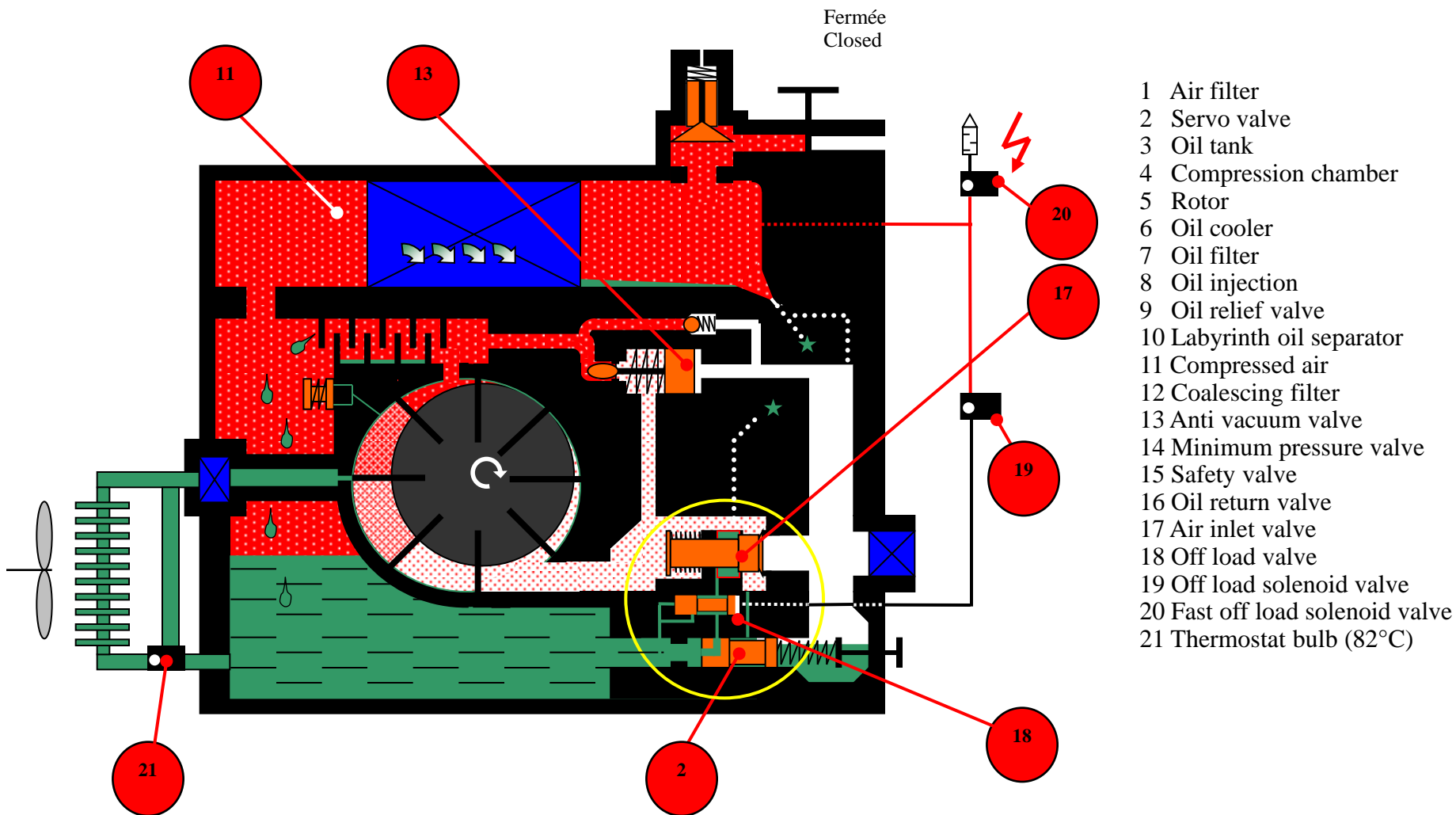
PRINCIPLE: GENERAL VIEW



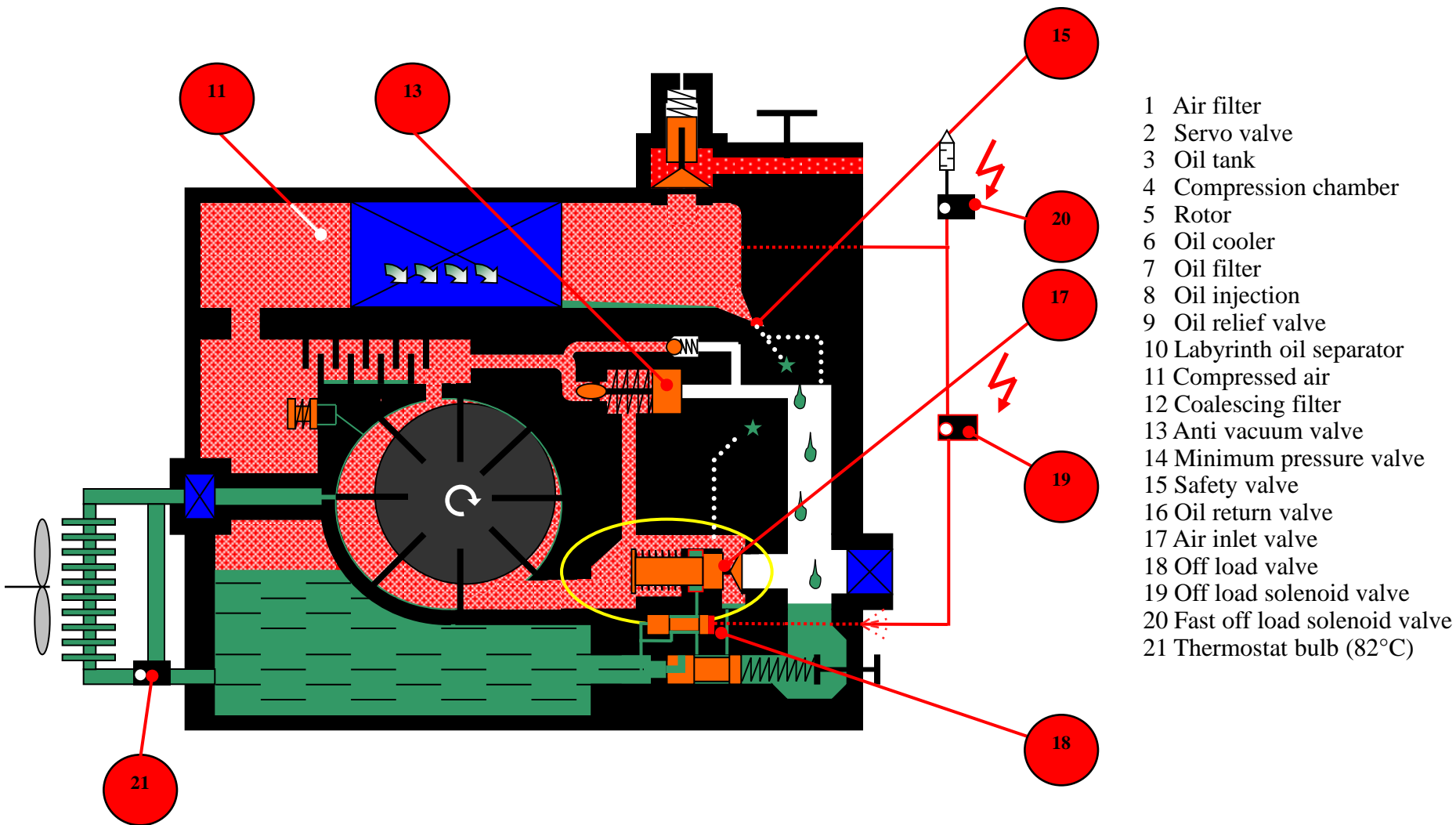
PRINCIPLE: FULL FLOW



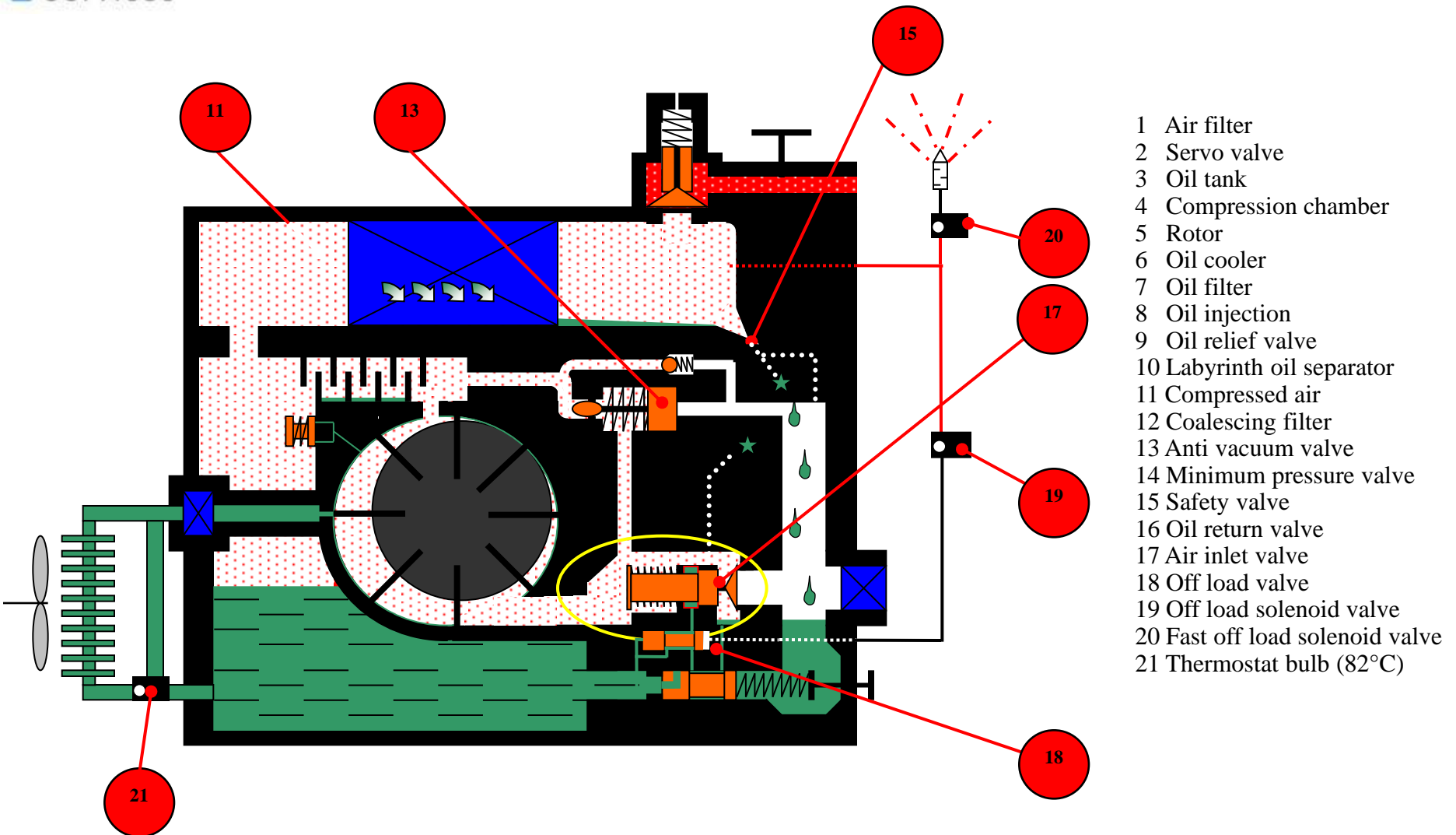
PRINCIPLE: NO FLOW



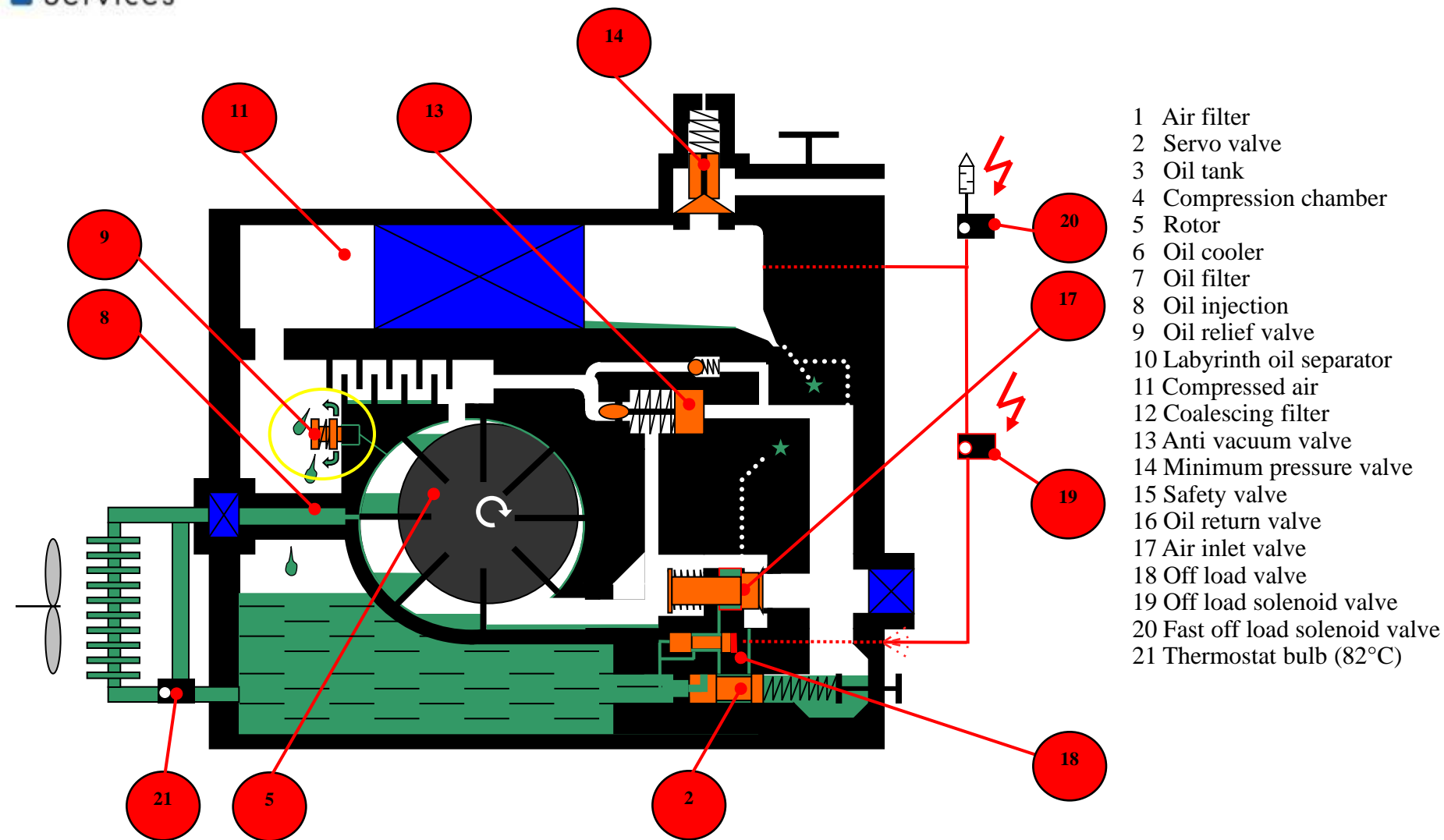
PRINCIPLE: STOPPING (60 sec)



PRINCIPLE: JUST STOPPED (after 60 sec)



PRINCIPLE: STARTING



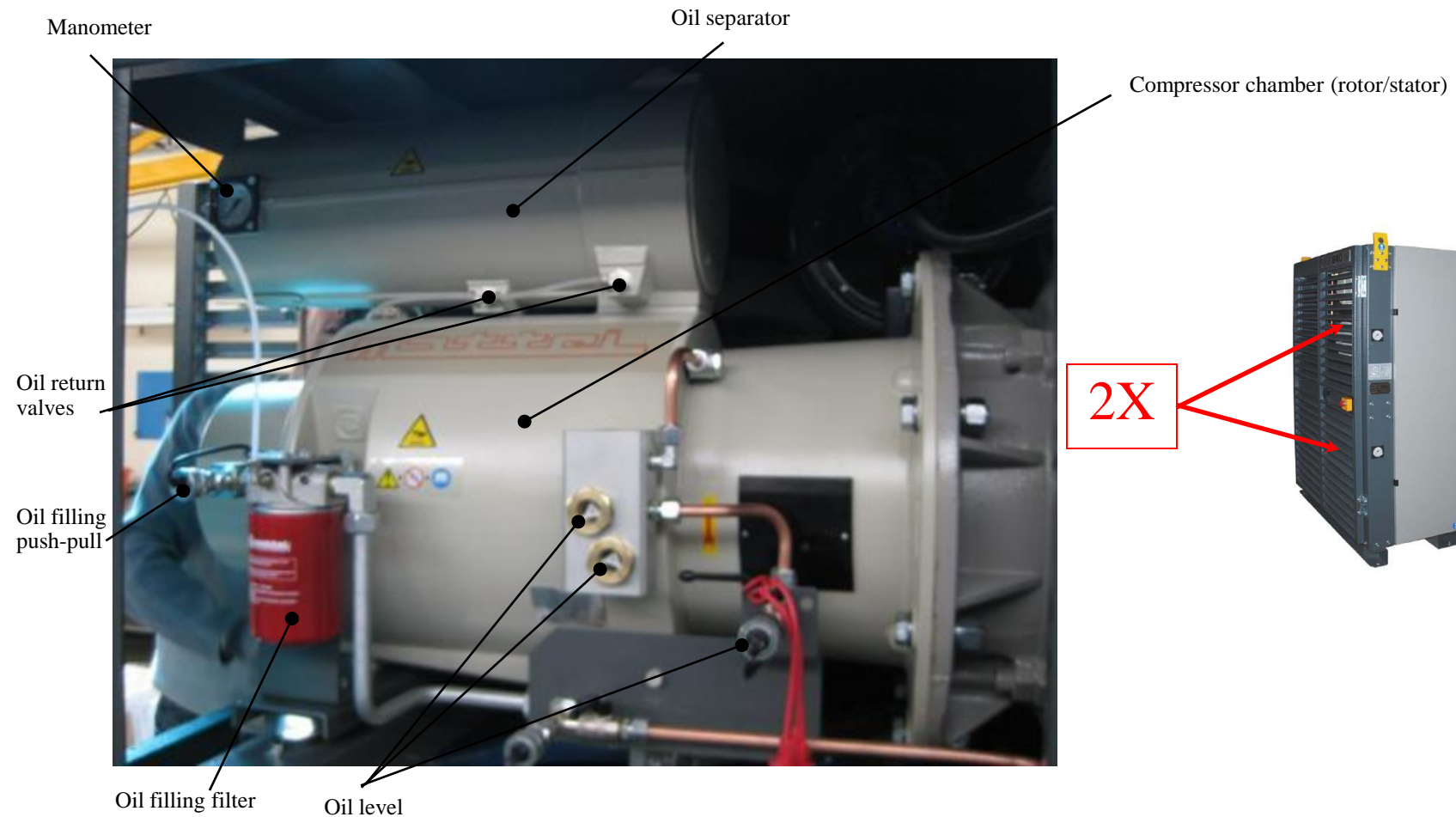
EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

DETAILS OF COMPONENTS

Flow Max = 14 700 l/mn

7.5 bar

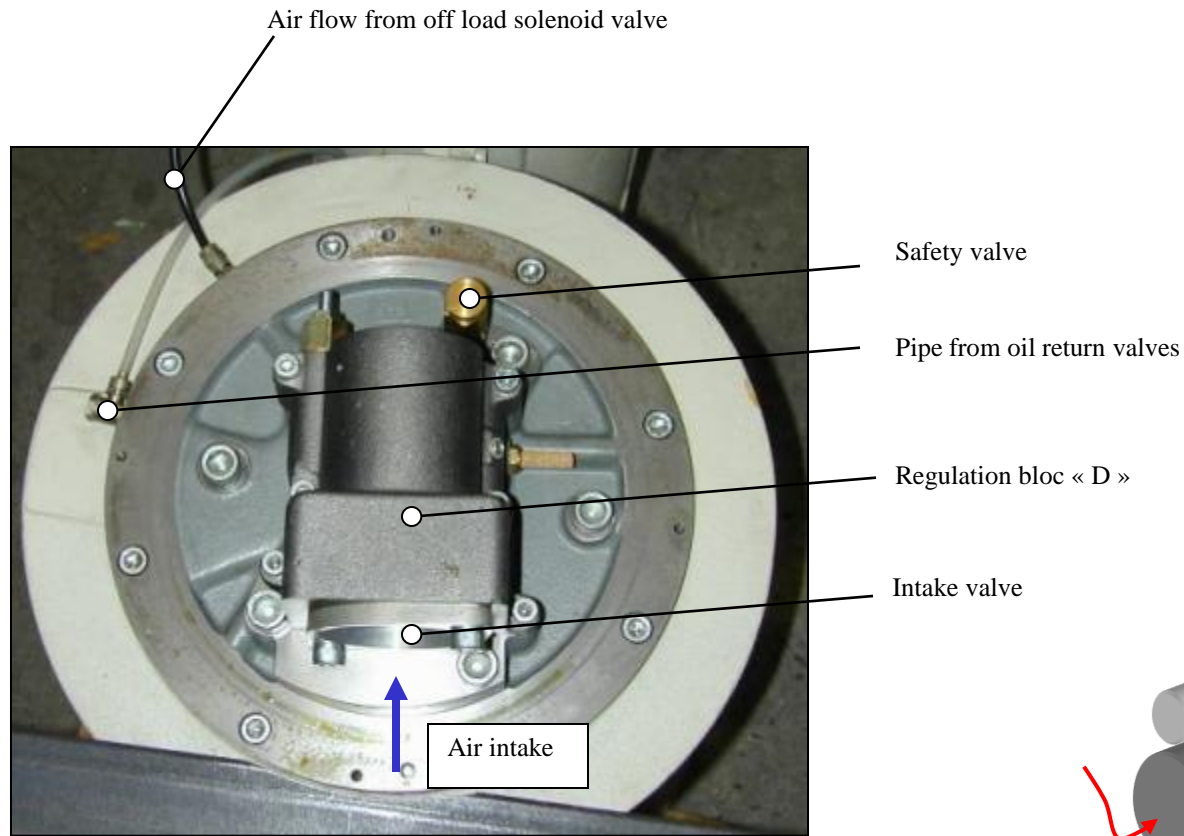
COMPRESSOR OVERALL VIEW



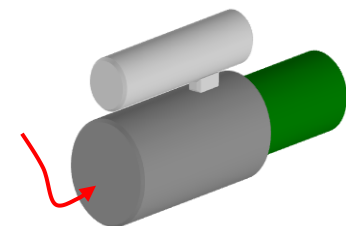
2X



FRONT VIEW: "INTAKE"

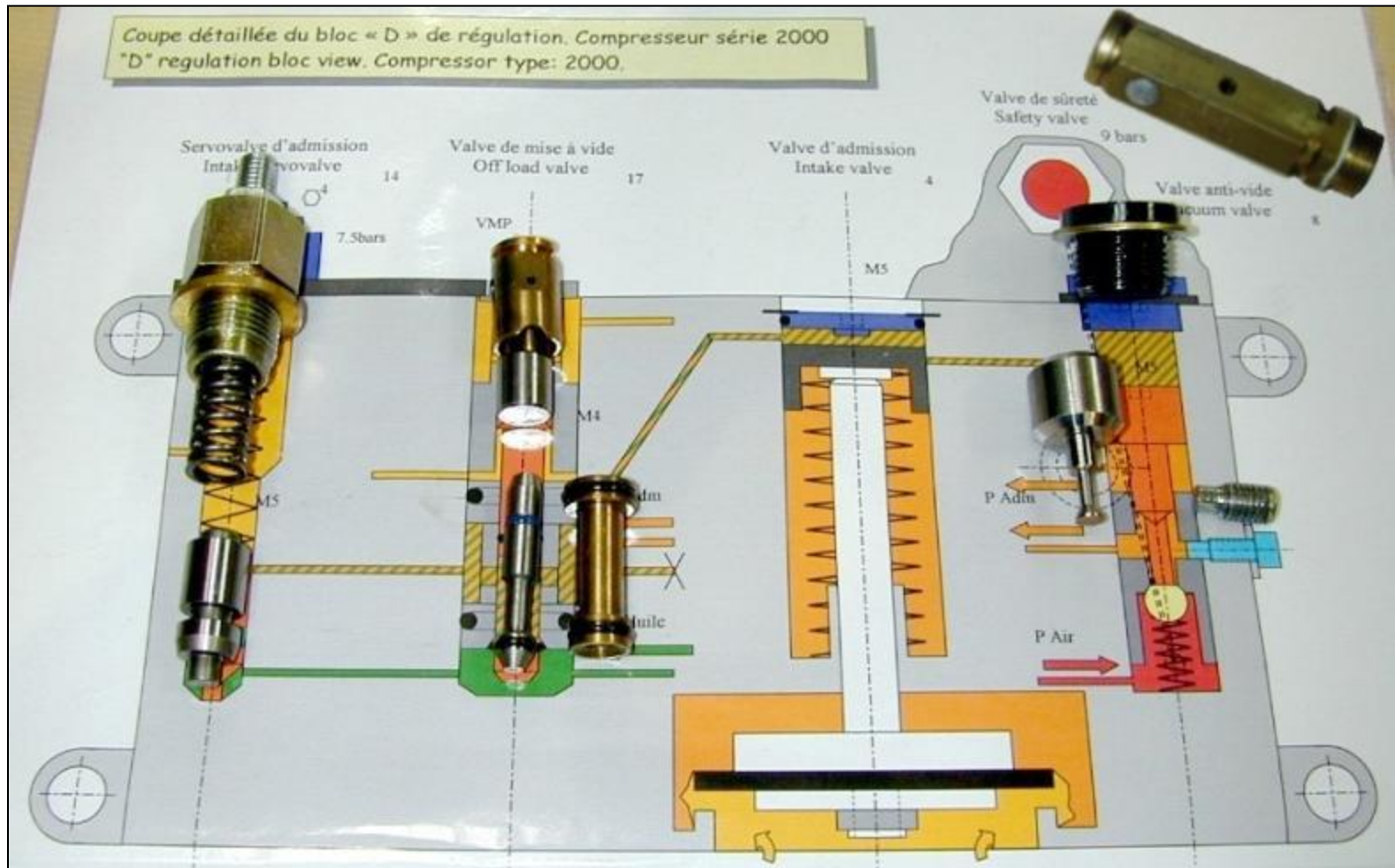


Front view: intake

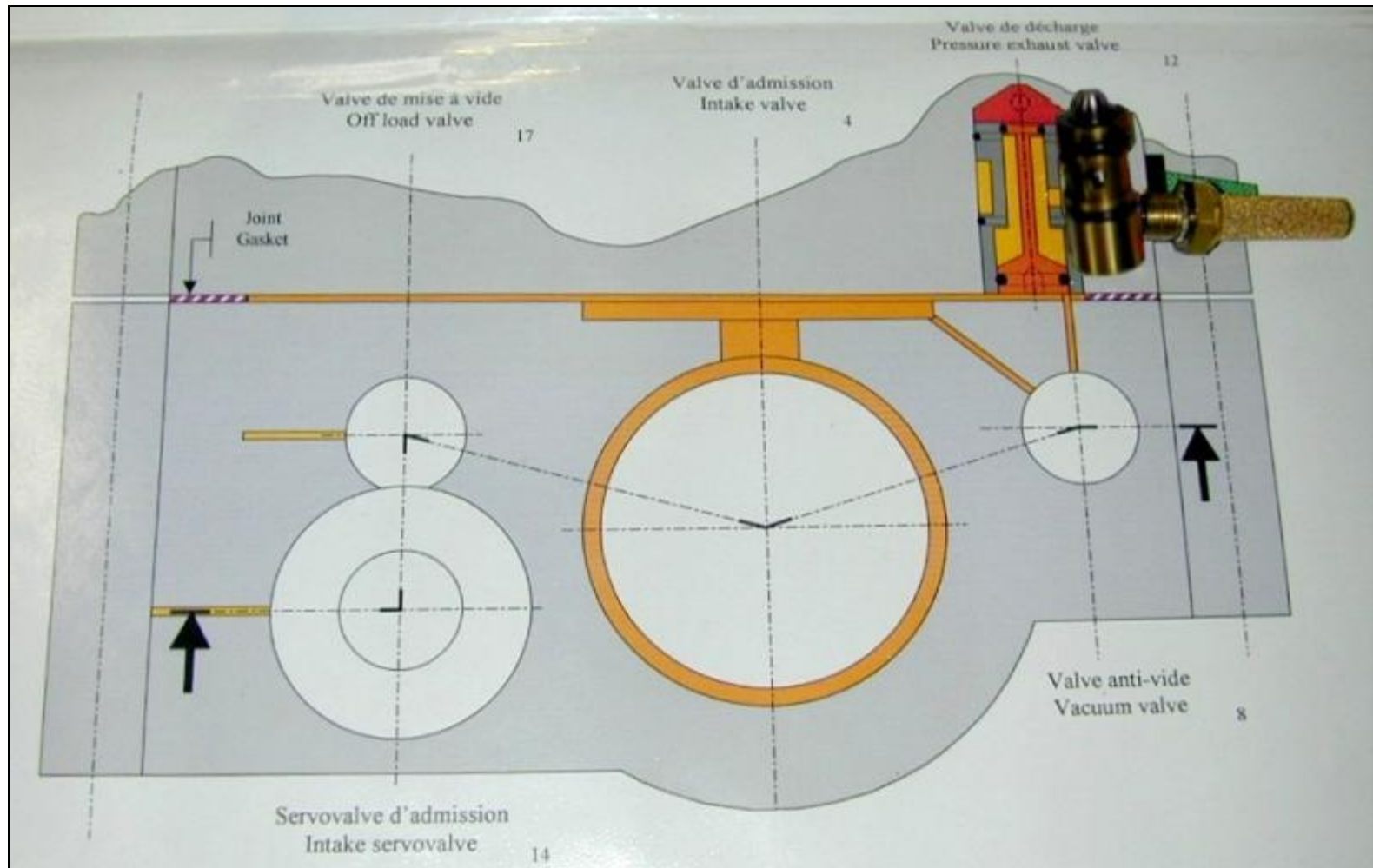


Location

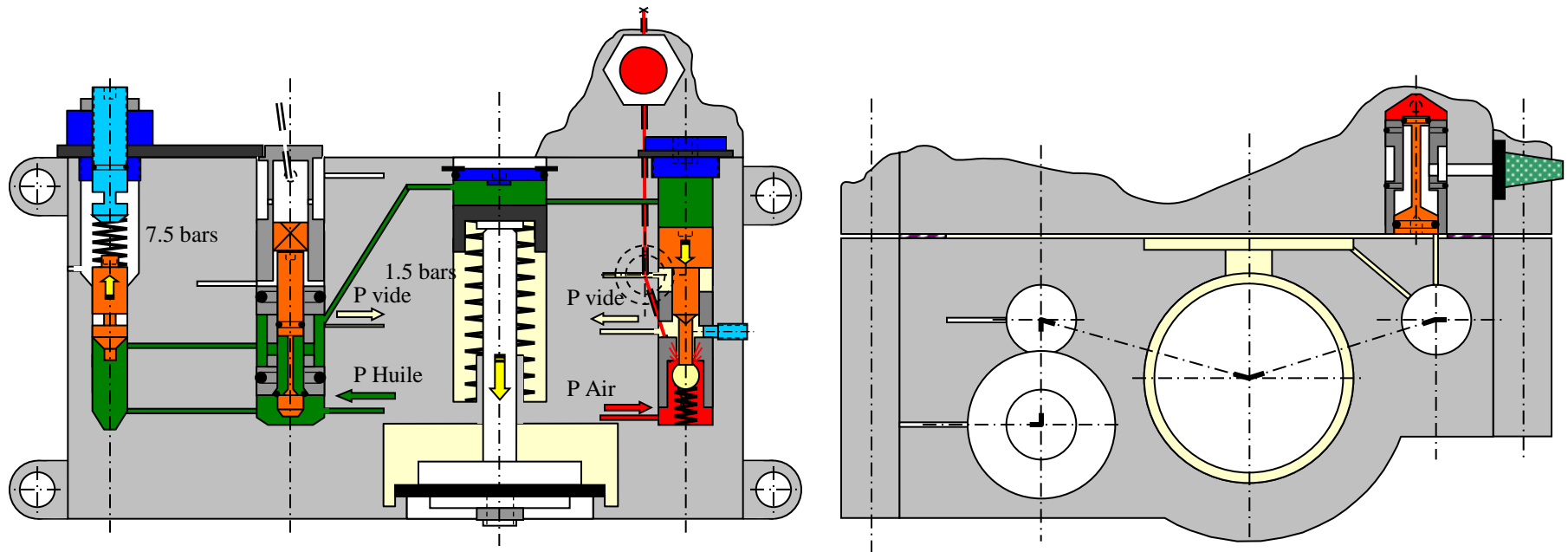
SECTION VIEW OF REGULATION BLOC “D”



SECTION VIEW OF REGULATION BLOC “D”



NO FLOW



Explanation :







No air compressed demand.

The pressure increases to 7.5 bar.

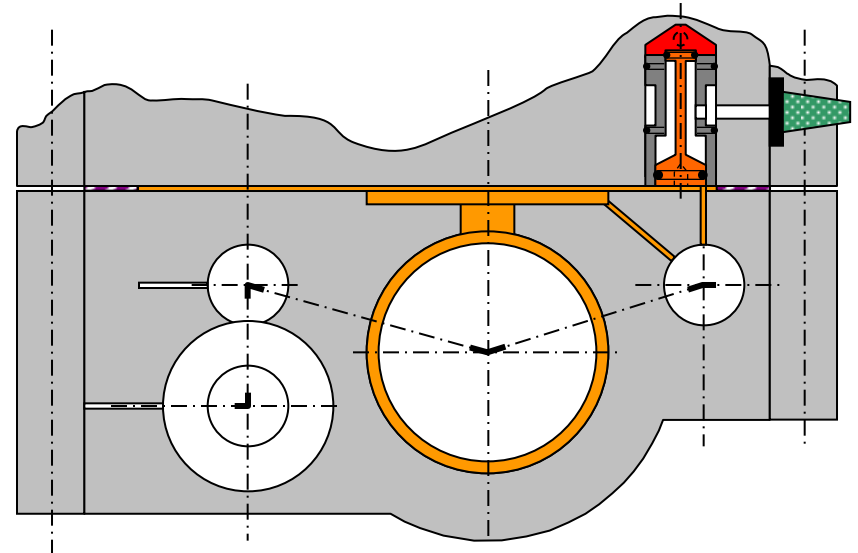
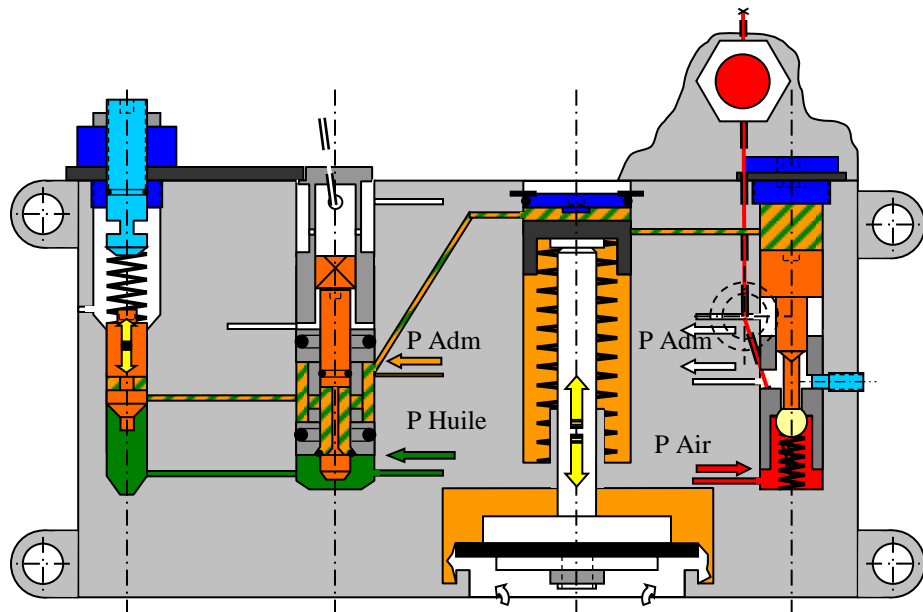
The intake valve closes because of the pressure of oil.

The rotor rotation creates a vacuum at the intake.

The oil pressure pilots the anti vacuum valve. This valve opens and discharges a small quantity of air to the intake to keep a good functioning of the rotor and vanes.

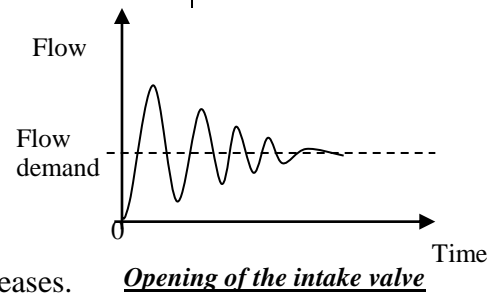
	High pressure of air
	Medium pressure of air
	Atmospheric pressure of air
	Vacuum
	Oil pressure
	Pilot pressure Air/Oil







FLOW REGULATION



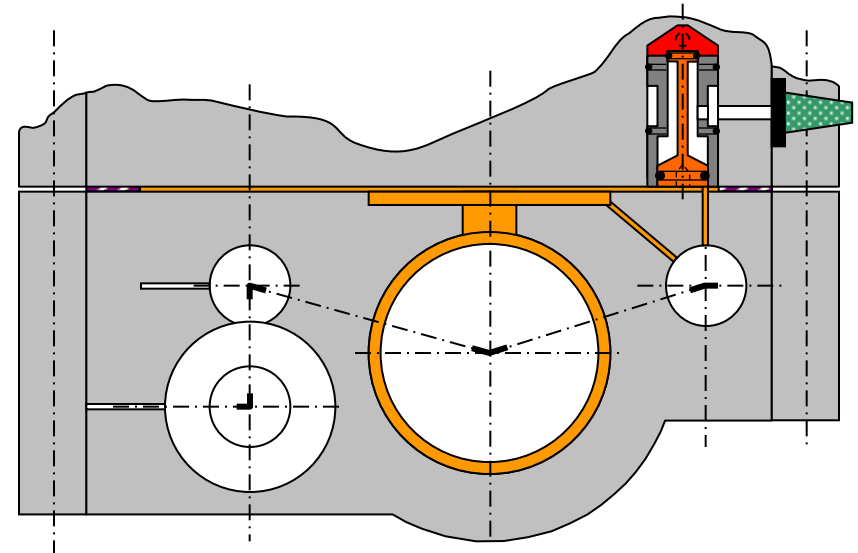
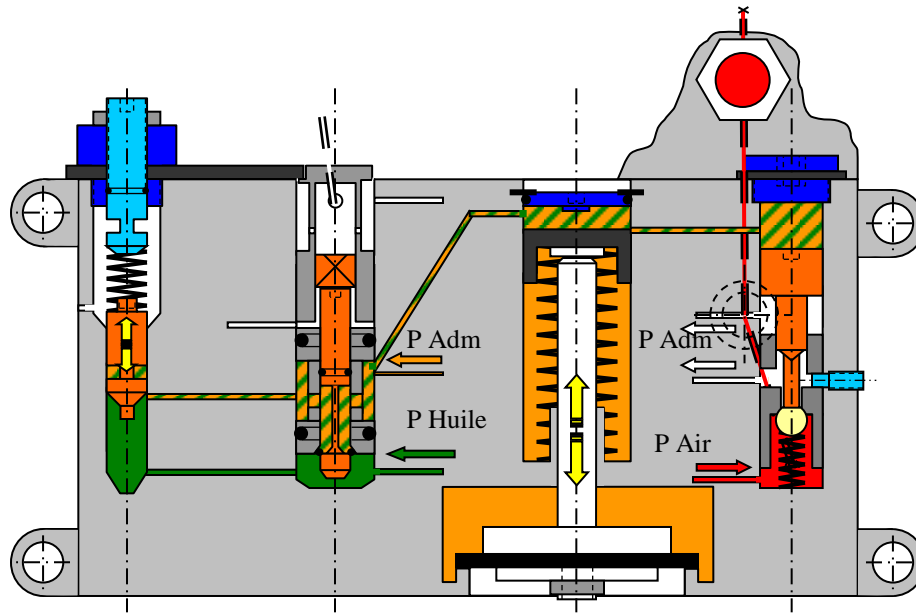
Explanation :

Air compressed flow is wanted.
 The internal pressure decreases.
 The oil pressure decreases and the intake valve opens.
 The admitted air is compressed and the internal pressure increases.
 The intake servo valve is piloted and the intake valve closes.
 The intake valve balances to give the needed flow of compressed air.



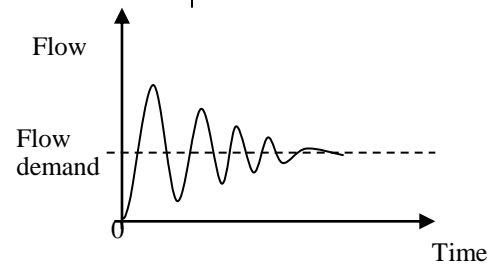
	High pressure of air
	Medium pressure of air
	Atmospheric pressure of air
	Vacuum
	Oil pressure
	Pilot pressure Air/Oil

FLOW REGULATION









Explanation :

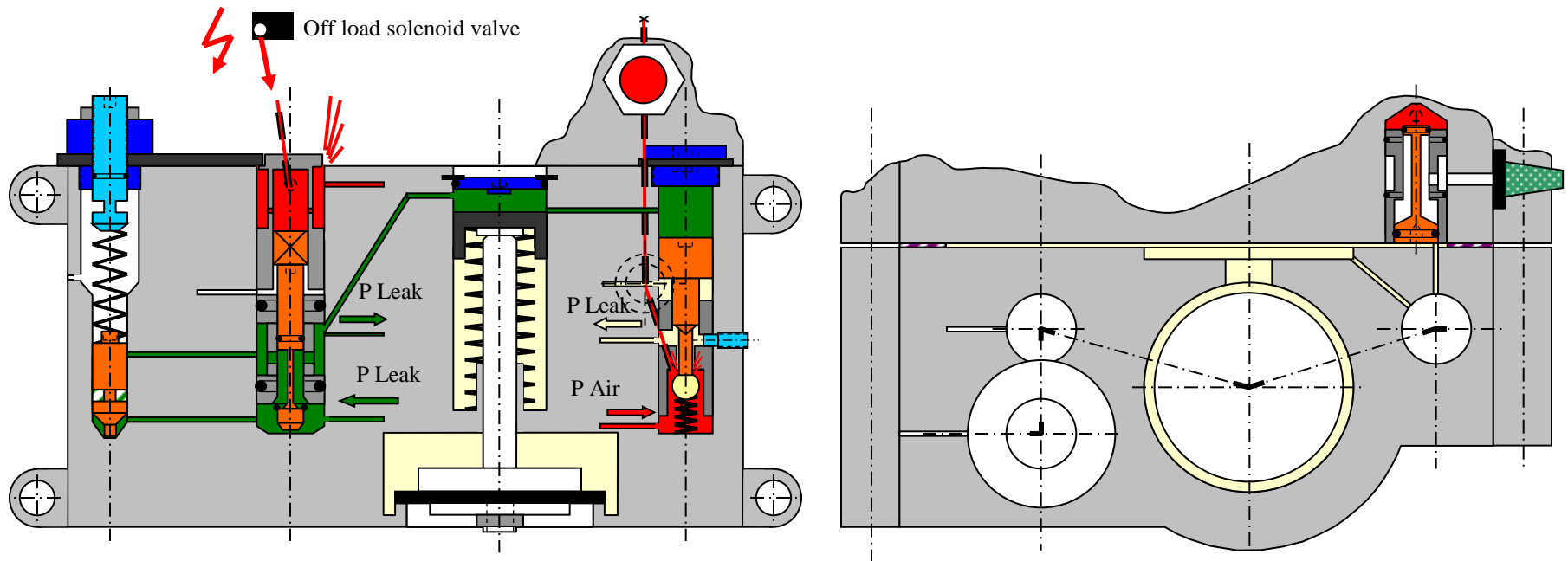
Air compressed flow is wanted.
 The internal pressure decreases.
 The oil pressure decreases and the intake valve opens.
 The admitted air is compressed and the internal pressure increases.
 The intake servo valve is piloted and the intake valve closes.
 The intake valve balances to give the needed flow of compressed air.



Opening of the intake valve

	High pressure of air
	Medium pressure of air
	Atmospheric pressure of air
	Vacuum
	Oil pressure
	Pilot pressure Air/Oil

STOPPING (60 sec)



Explanation :

No air compressed demand. The compressor doesn't give any flow.







The « normal stop » button is actuated.

At this moment the off load valve is energized. The off load valve allow the passage of oil which pilots and closes the intake valve. The internal pressure of the compressor discharges to the atmosphere (air without oil).

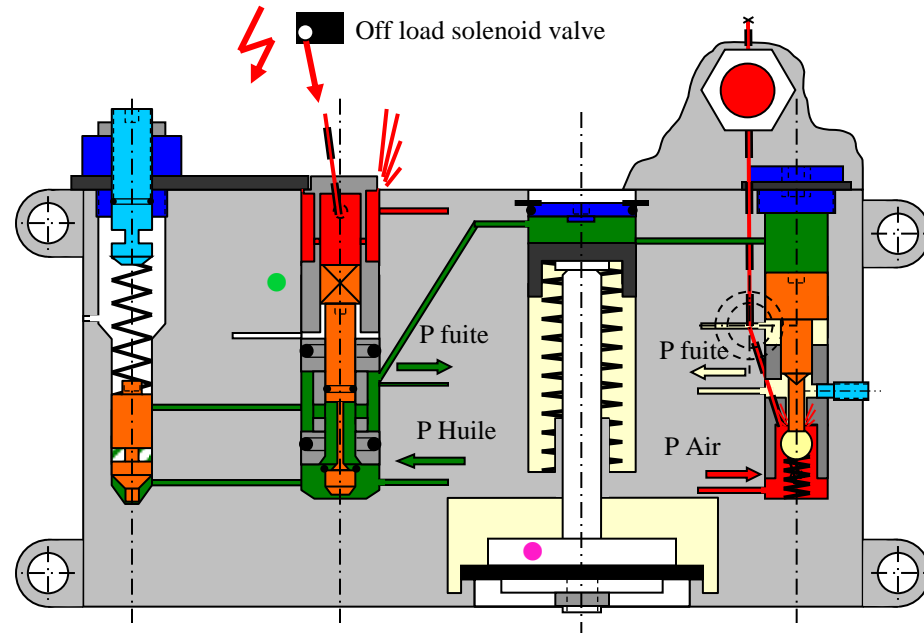
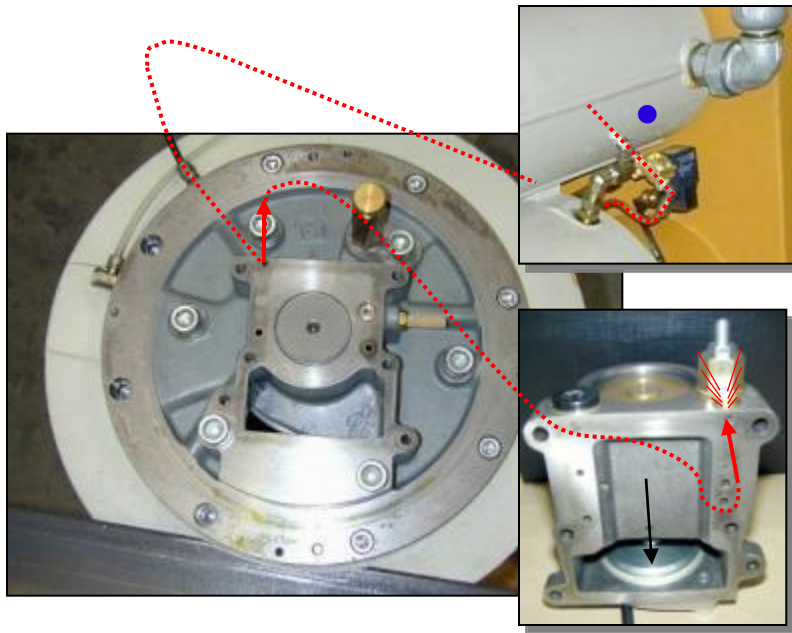
When the pressure reaches 1,5 bar, the spring of the intake valve is not able to ensure the airtightness.

The intake valve opens and regulates to a 1,5 bar air pressure.

The motor is still running







	High pressure of air
	Medium pressure of air
	Atmospheric pressure of air
	Vacuum
	Oil pressure
	Pilot pressure Air/Oil

STOP (60 sec)

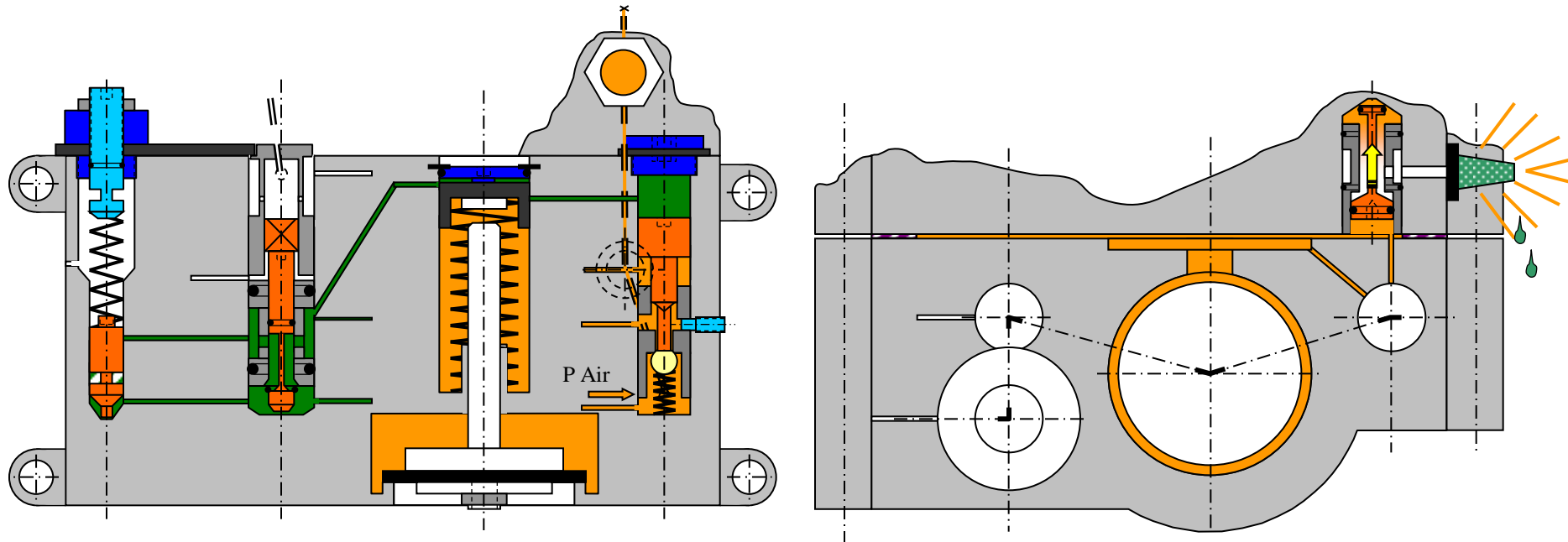


Explanation :

Off load solenoid valve (●) is energized. The air pressure pilots the off load piston (●) which allows the passage of oil directly to the intake valve (●) (no passage through the servo valve). The intake valve closes. The internal pressure of the compressor discharges to the inlet. When the pressure reaches 1,5 bar, the spring of the intake valve is not able to ensure the airtightness. The intake valve opens and regulates to a 1,5 bar air pressure.







	High pressure of air
	Medium pressure of air
	Atmospheric pressure of air
	Vacuum
	Oil pressure
	Pilot pressure Air/Oil

MOTOR STOP (after 60 sec)

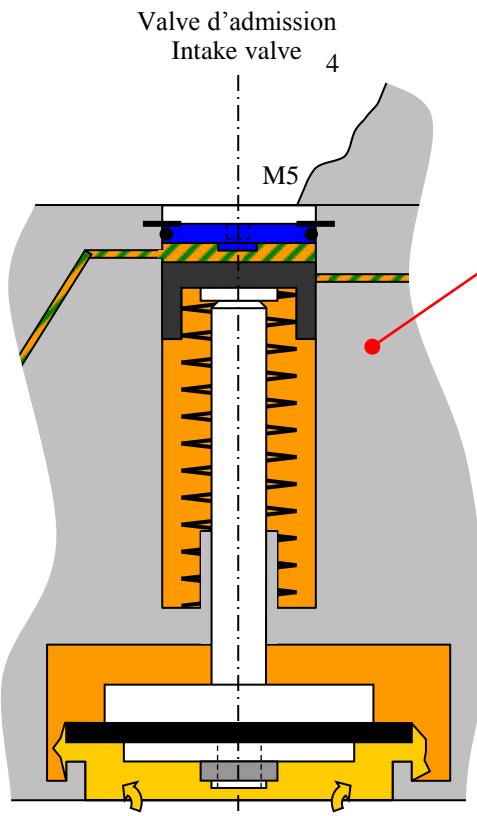


Explanation :

After 60 sec the motor is stopped.
 The internal pressure is 1,5 bar.
 The pressure exhaust valve opens because of the pressure acting on its different areas.
 The 1,5 bar pressure discharges through the exhaust valve.
 The air is oily. A small quantity of oil is collected in the intake casing.

	High pressure of air
	Medium pressure of air
	Atmospheric pressure of air
	Vacuum
	Oil pressure
	Pilot pressure Air/Oil

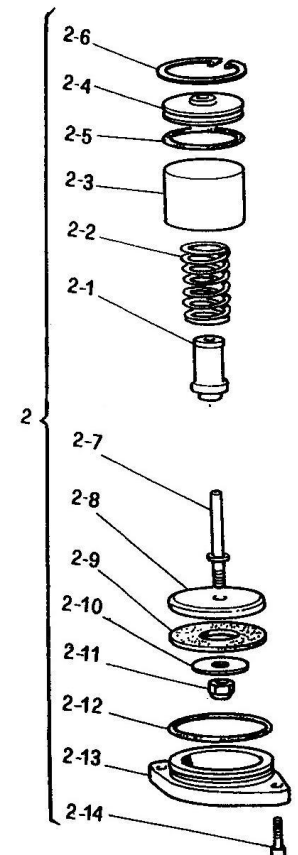
INTAKE VALVE



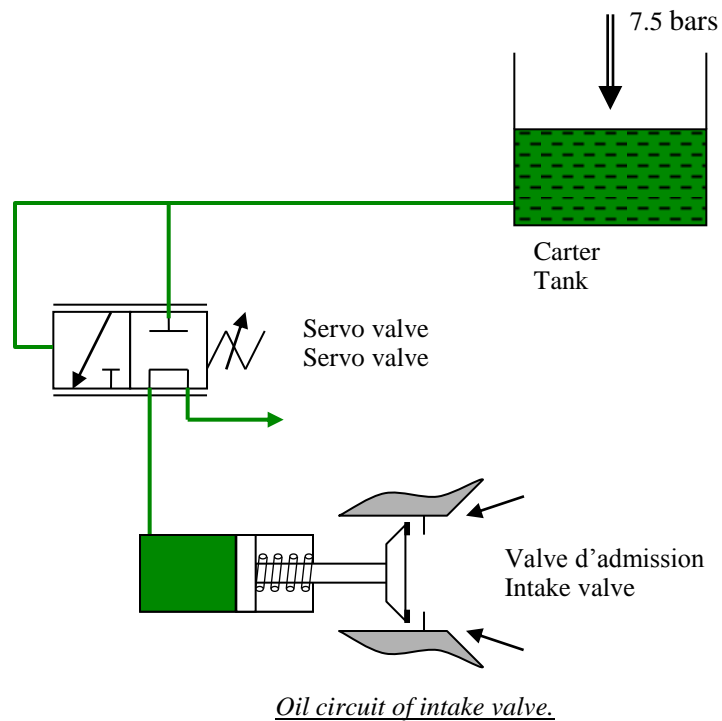
IMPORTANT:
Check the intake seal.
Teflon washer (Réf. 2-9).



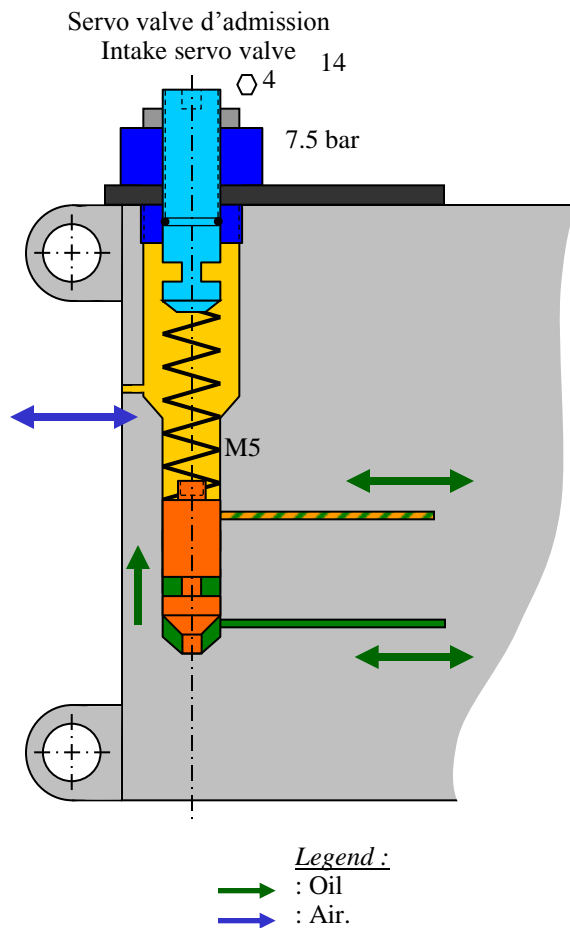
Intake valve



SERVO VALVE



INTAKE SERVO VALVE



Intake servo valve

IMPORTANT :

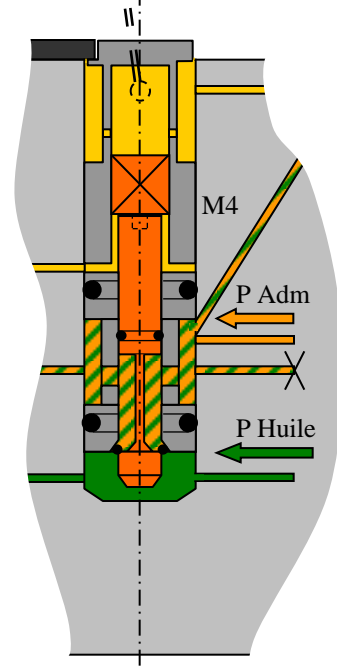
To adjust the servo valve to 7.5 bar it is important to use a calibrated pressure gauge.
The pressure gauge fitted on the compressor is not able to give an accurate value of the adjustment

OFF LOAD VALVE



Off load valve

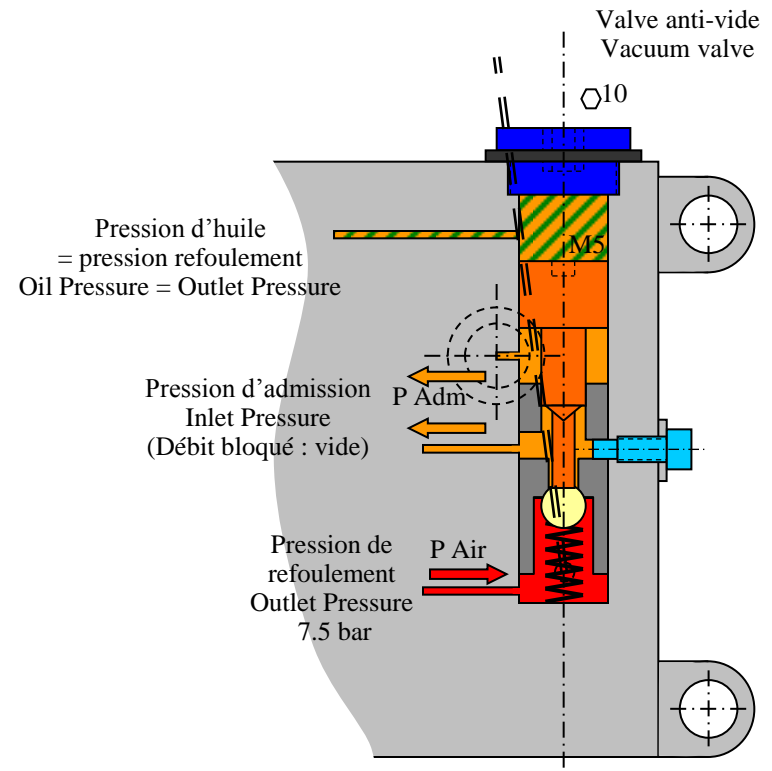
Valve de mise à vide
Off load valve
Electro de mise à vide
Off load splenoid valve



ANTI VACUUM VALVE



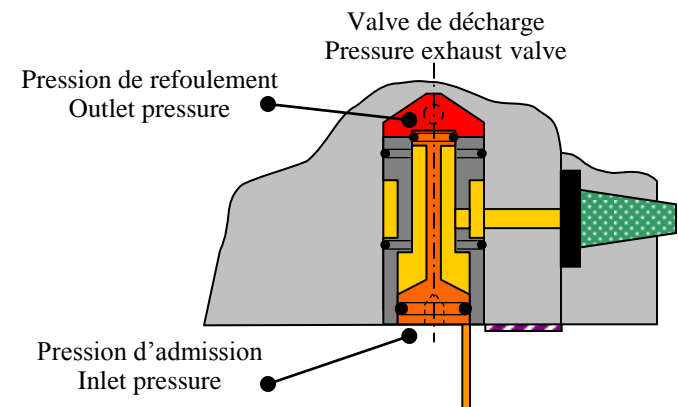
Vacuum valve



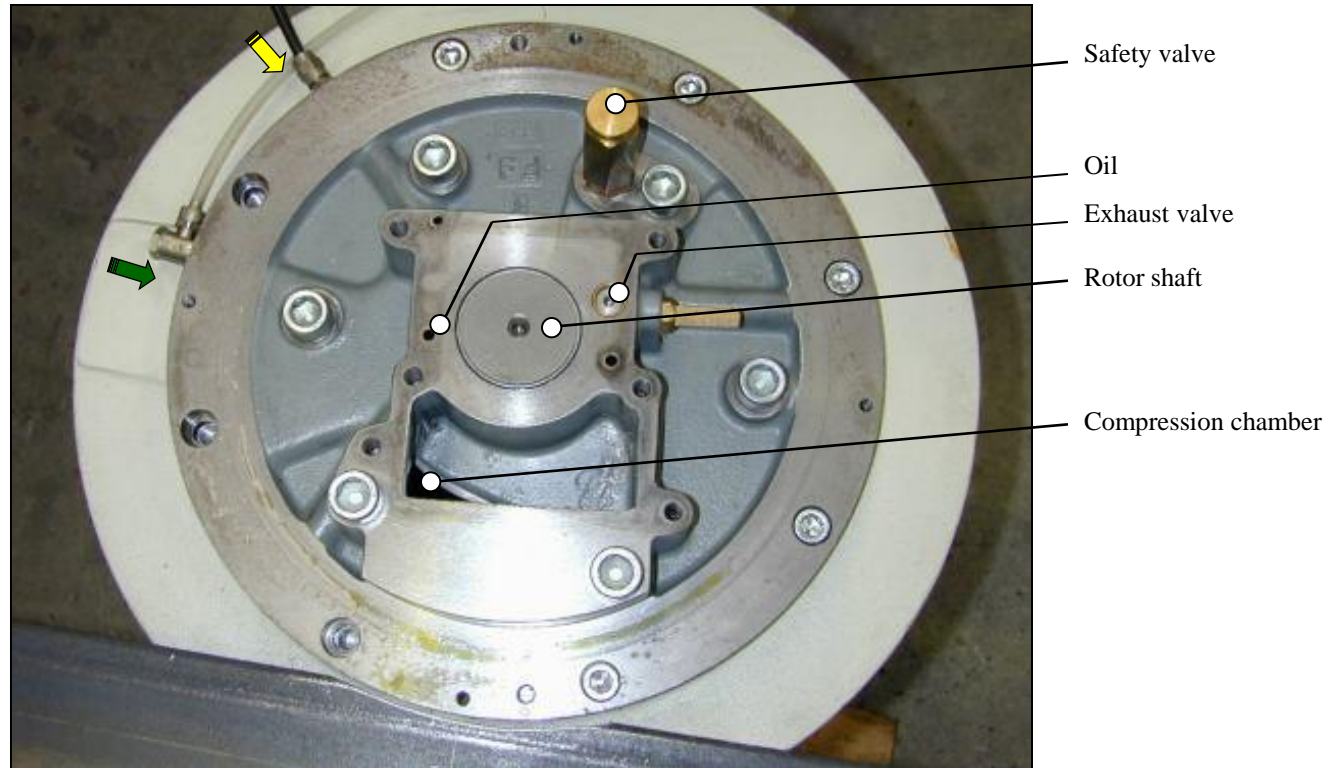
PRESSURE EXHAUST VALVE



Exhaust valve





END COVER: INTAKE SIDE



Bearing (Inlet side).

Legend :

-  : Air flow to pilot the off load valve.
 : Oil return.

END COVER: INTAKE SIDE

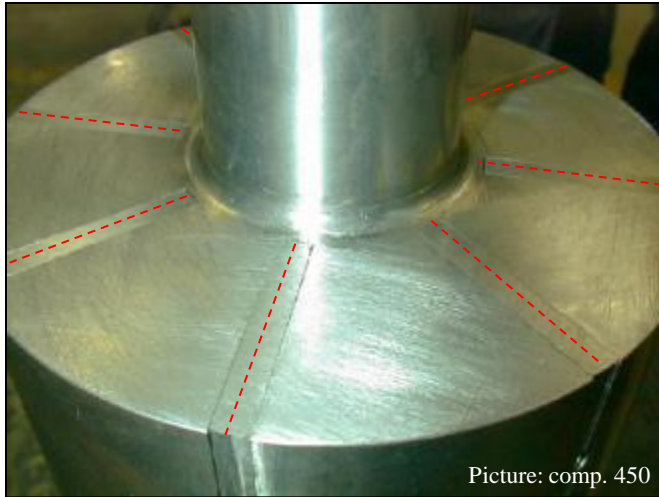


Axial lubrication of rotor.

Intake port

Bearing: intake side

AXIAL CLEARANCE ROTOR / VANES



Picture: comp. 450

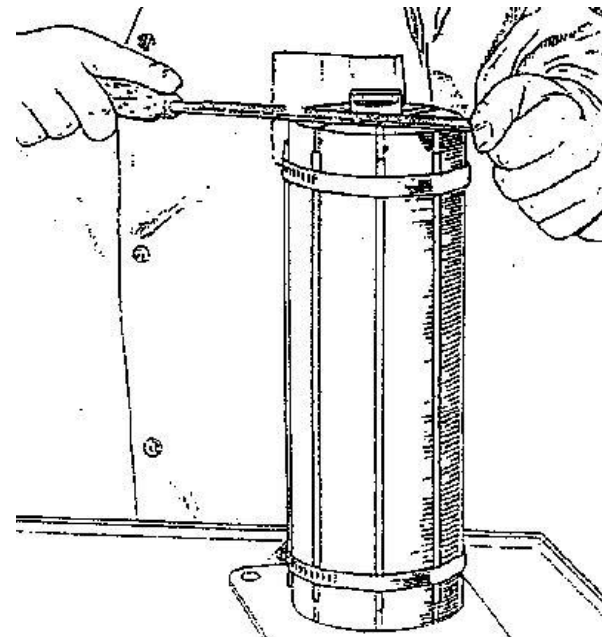
Rotor and vanes



Vaness (1 set = 3 vanes)

Axial clearance between rotor and vanes:

0 mm



Length adjustment

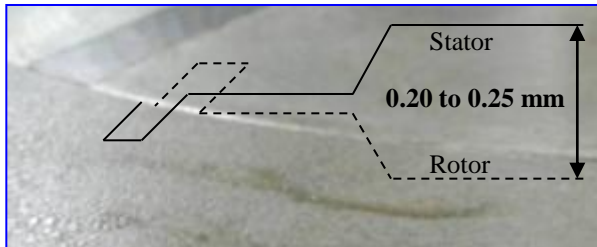
IMPORTANT:

The vanes sets must be length adjusted
Be careful not to invert vanes of different sets.
Replace all the vanes of one set in the same time.

AXIAL GAP



Rotor/stator



Total axial gap between rotor and stator :
0.20 to 0.25 mm

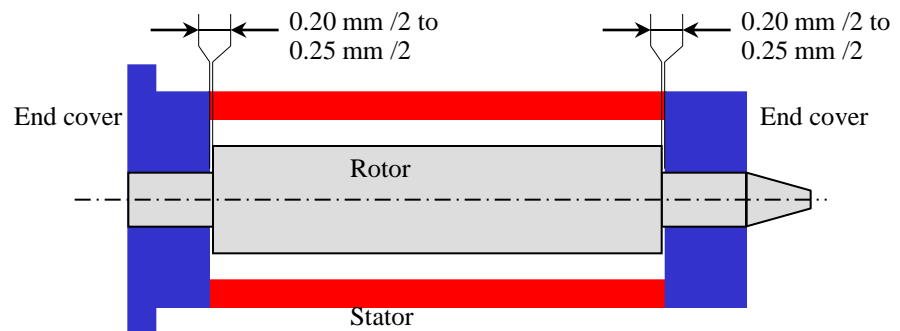
During reassembling it 's better to fit the more thin shim one side (0,05 mm) and to adjust the total gap (0,20 to 0,25 mm) with the thickness of the shim on the other side.

Thickness of shims:

0.05 mm	△△△
0.075 mm	△△
0.10 mm	△



Axial gap measurement

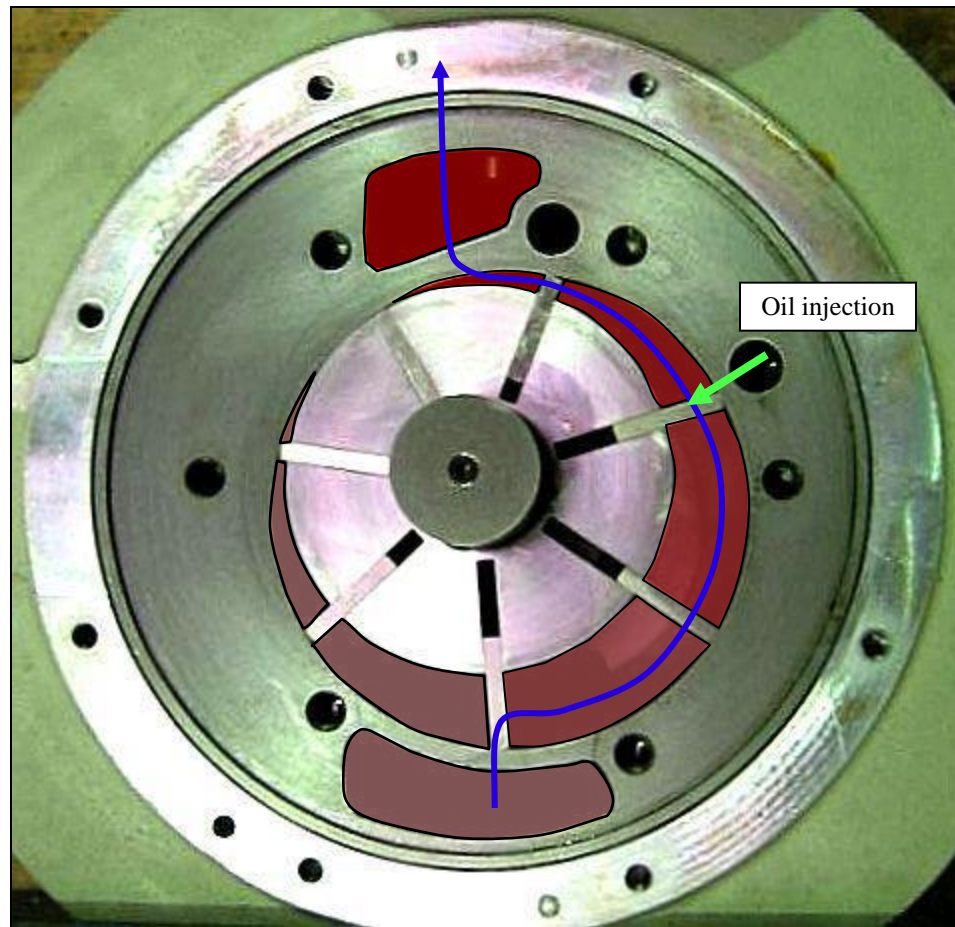


Axial gap when the compressor is running

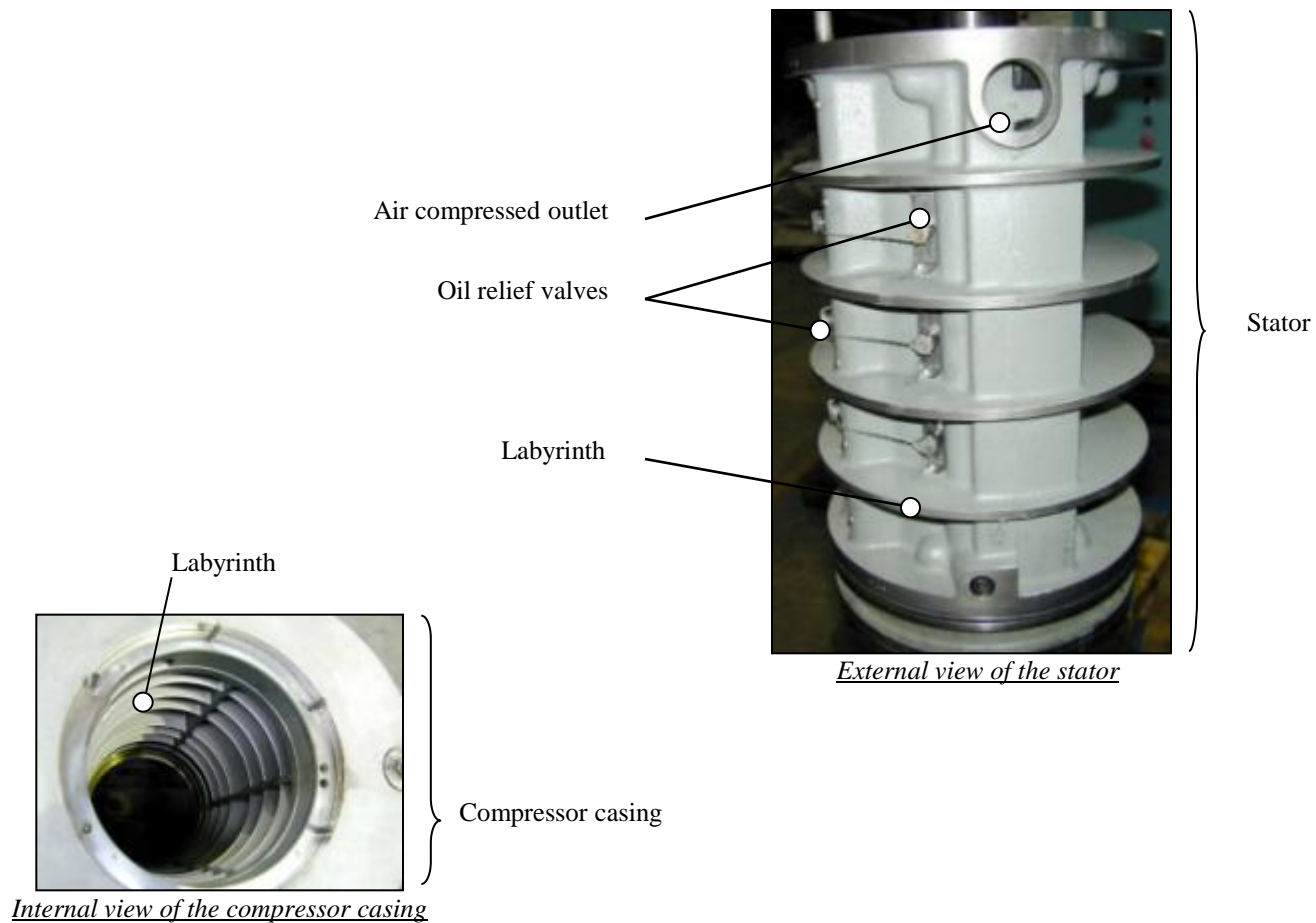
IMPORTANT :

The vanes sets must be length adjusted
Be careful not to invert vanes of different sets.
Replace all the vanes of one set in the same time.

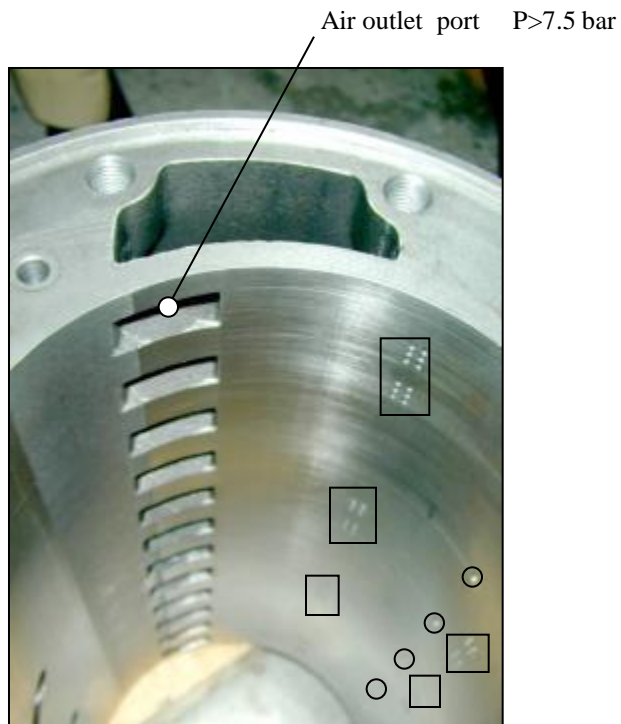
COMPRESSION CHAMBER



STATOR

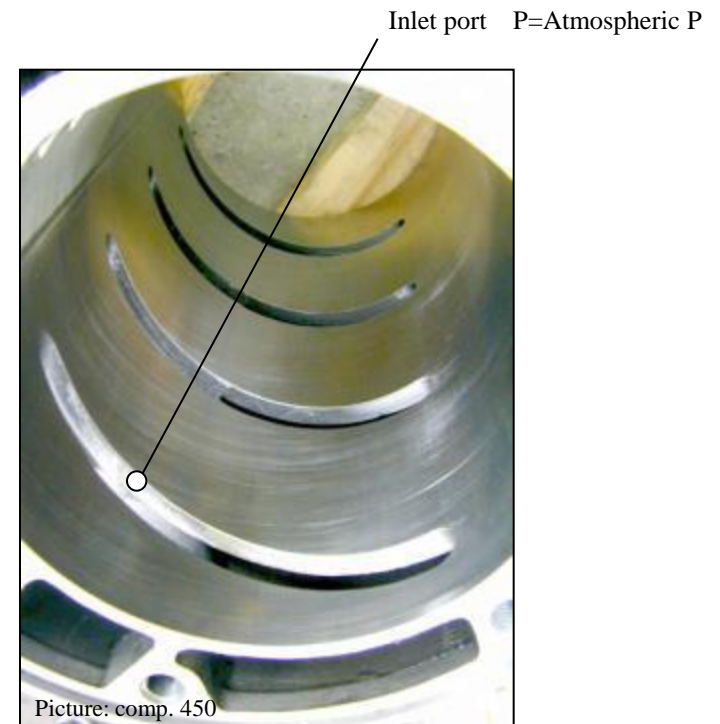


STATOR



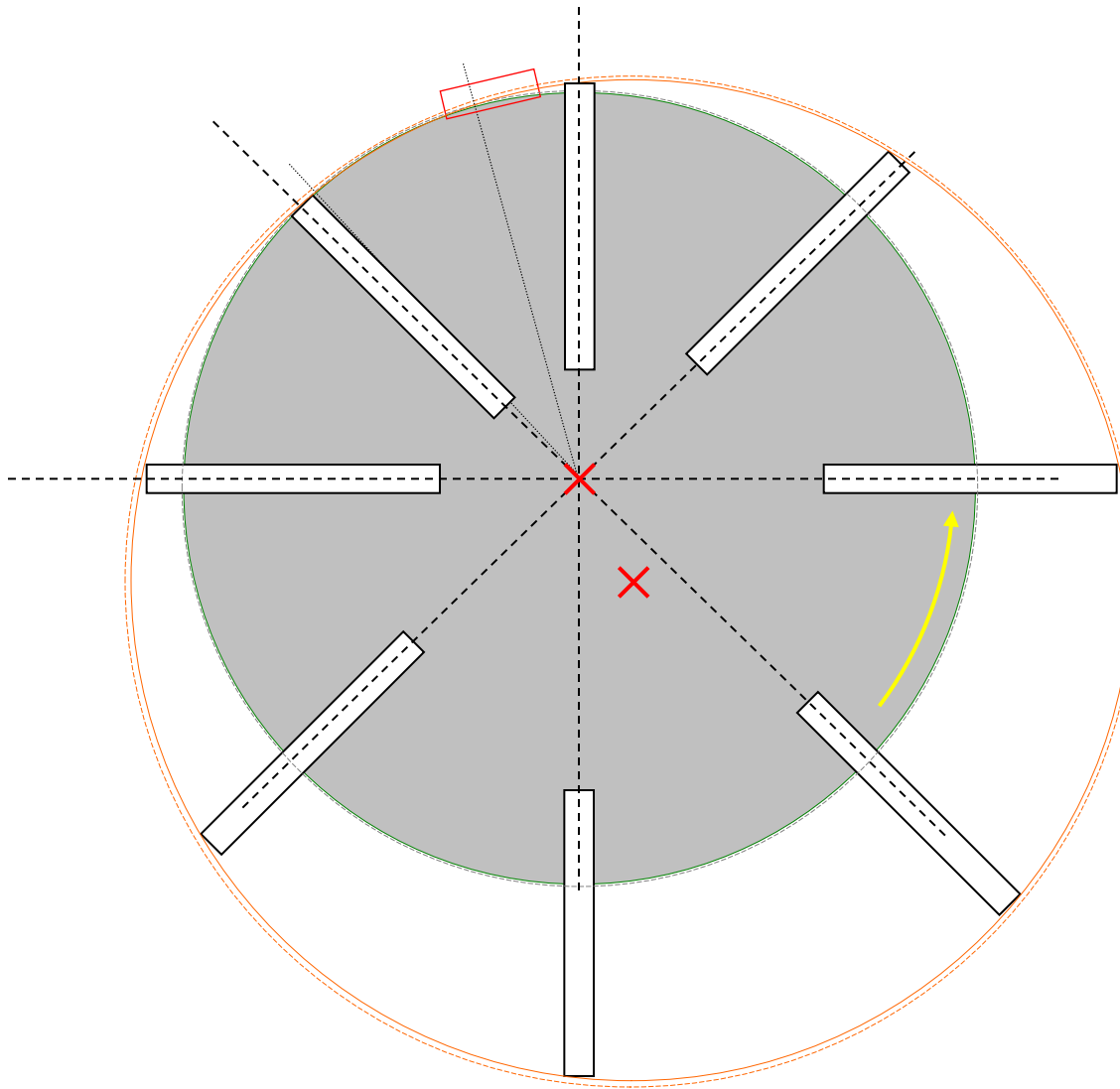
Internal view of the stator

- Legend :
- : Oil relief valve port
 - : Oil injection port

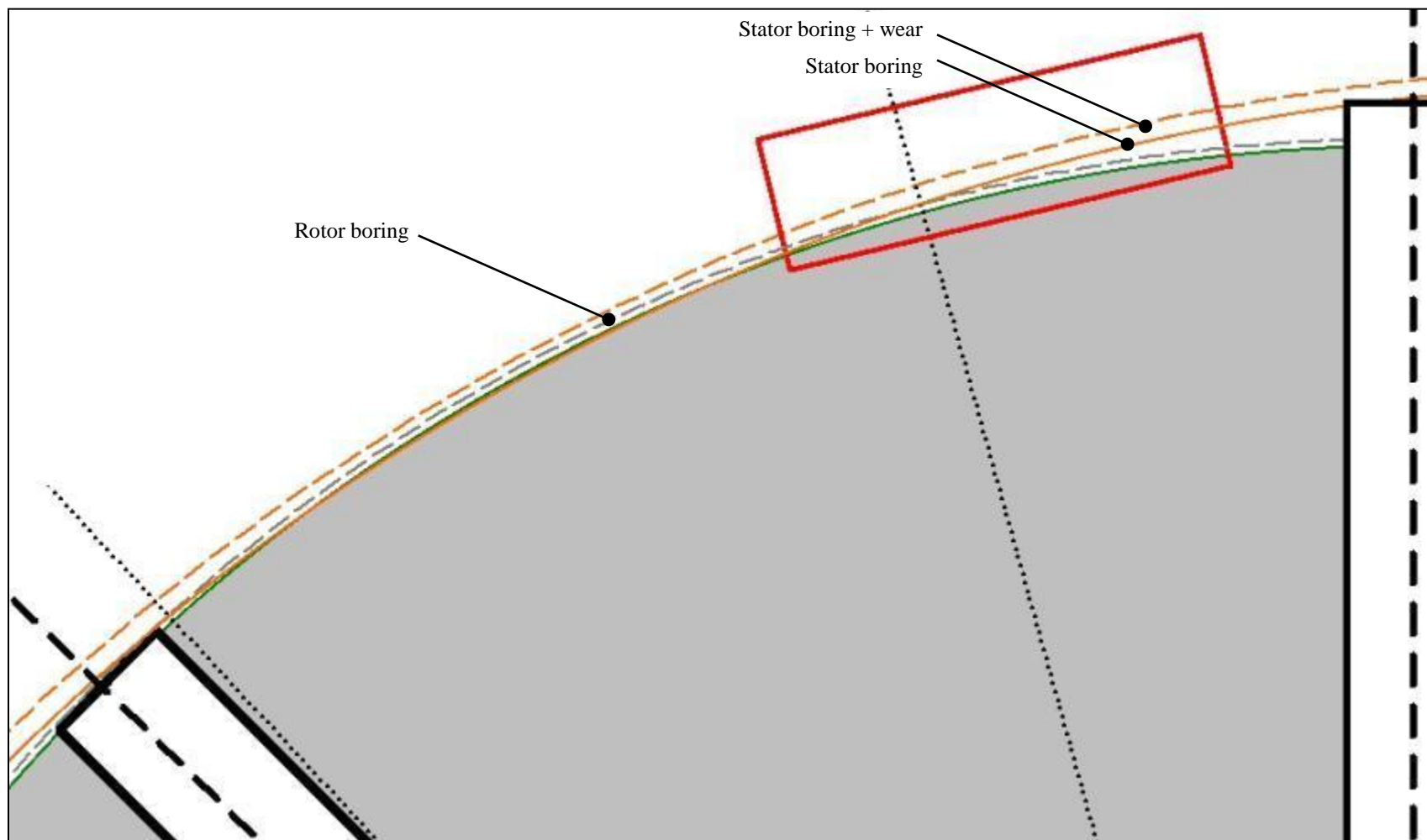


Internal view of the stator

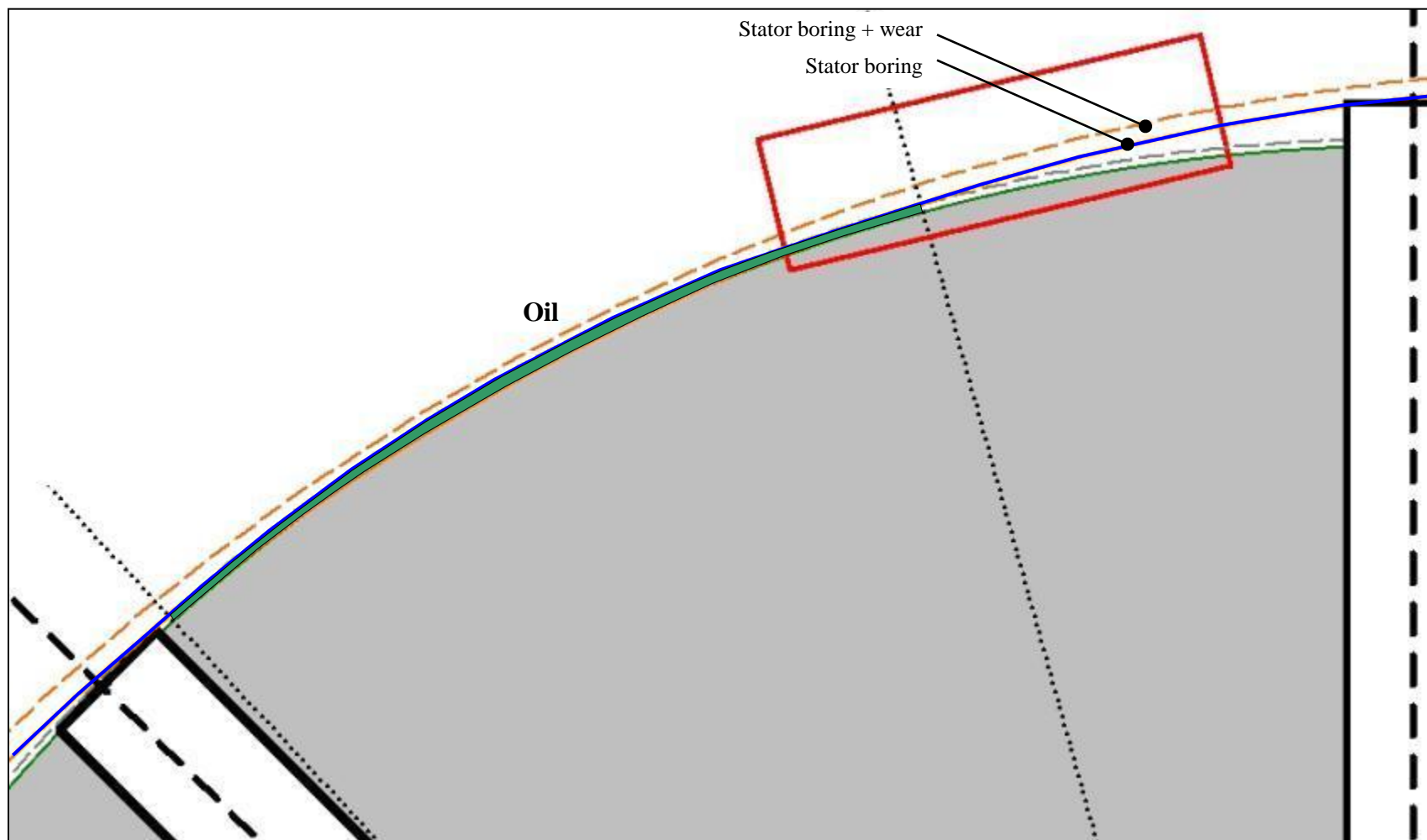
TANGENCE OF BORINGS



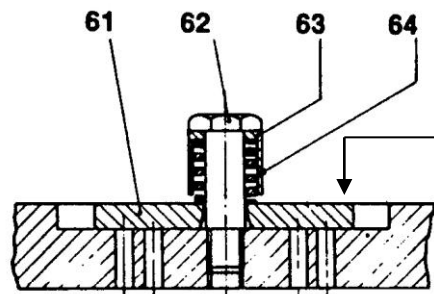
TANGENCE OF BORINGS



TANGENCE OF BORINGS

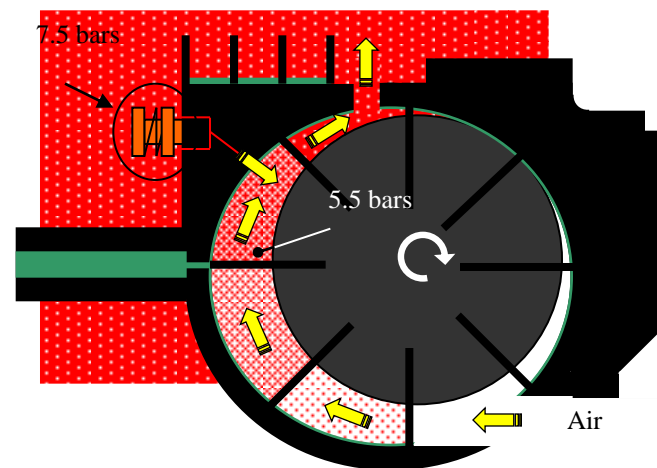


OIL RELIEF VALVES

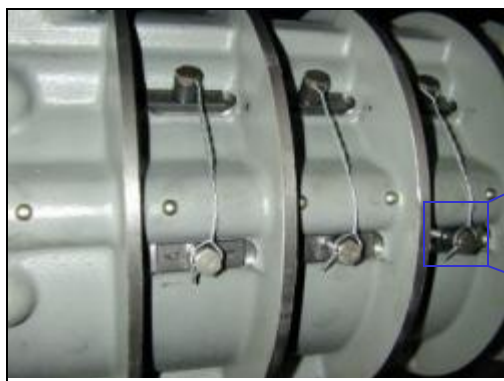


Oil relief valve (see picture : "External view of stator")

ALTO



If trouble : double stages compression.



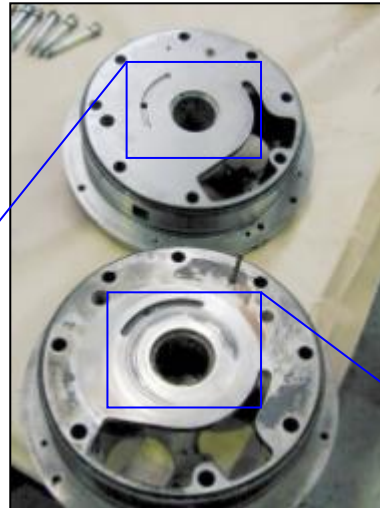
External view of stator



END COVERS AND AXIAL GAP

Surface of end covers must not be smooth (polished). The roughness is very important to hook the oil film. This oil film is primordial for the airtightness and the lubrication.

Roughness :
Ra= 1.6 à 2.5

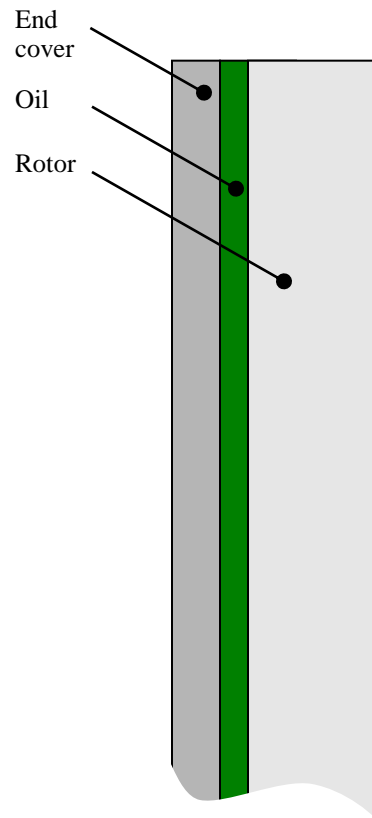


Non drive end cover (internal view)

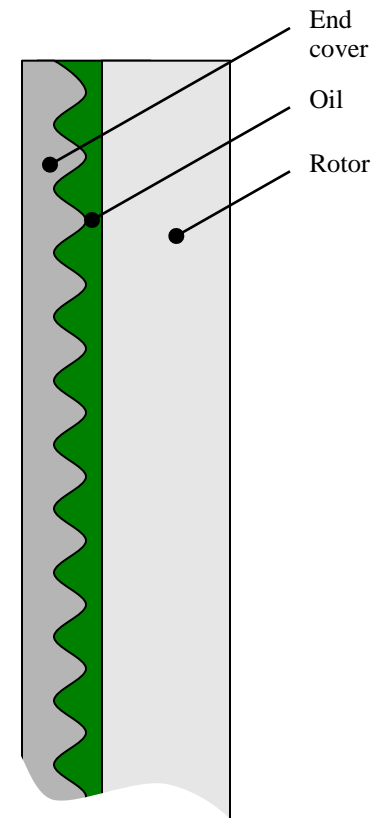
If the gap is too low we can have a seizing between the rotor and the stator because of frictions



ROUGHNESS OF END COVERS

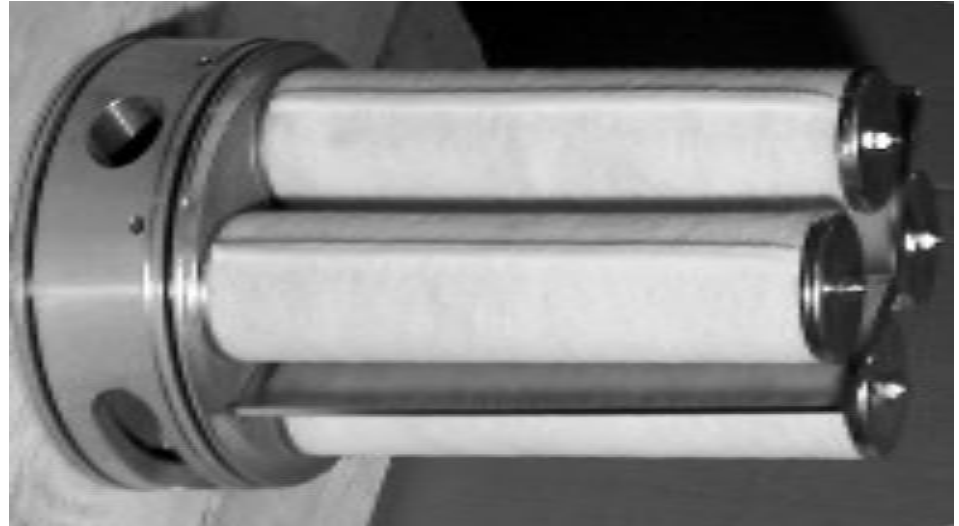


Bad lubrication



Good lubrication

OIL SEPARATOR CASING

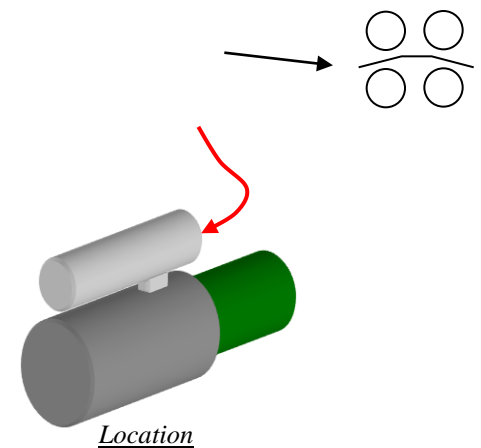


Draining of oil to the oil return valves.

Oil separator casing

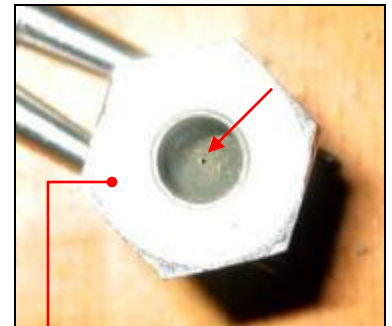
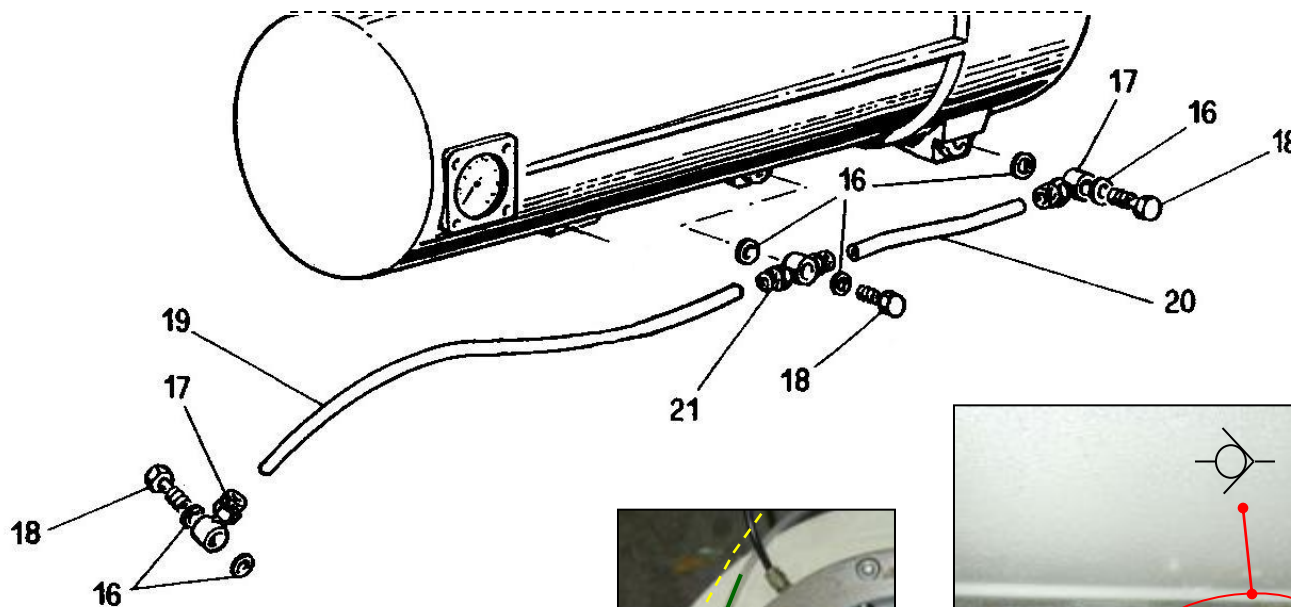


Oil return port

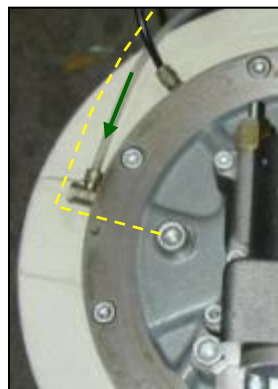


Location

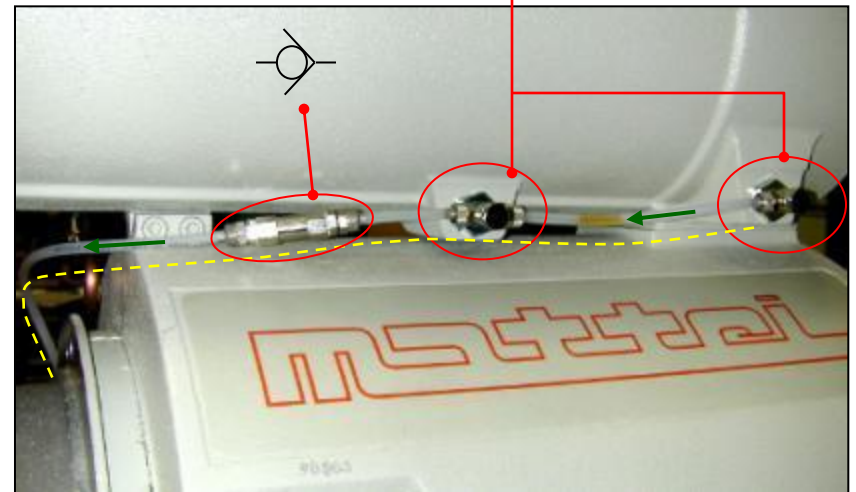
OIL RETURN VALVE



Calibrated orifice

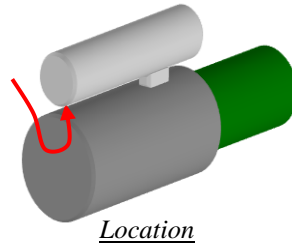


Front view



Oil return

MINIMUM PRESSURE VALVE

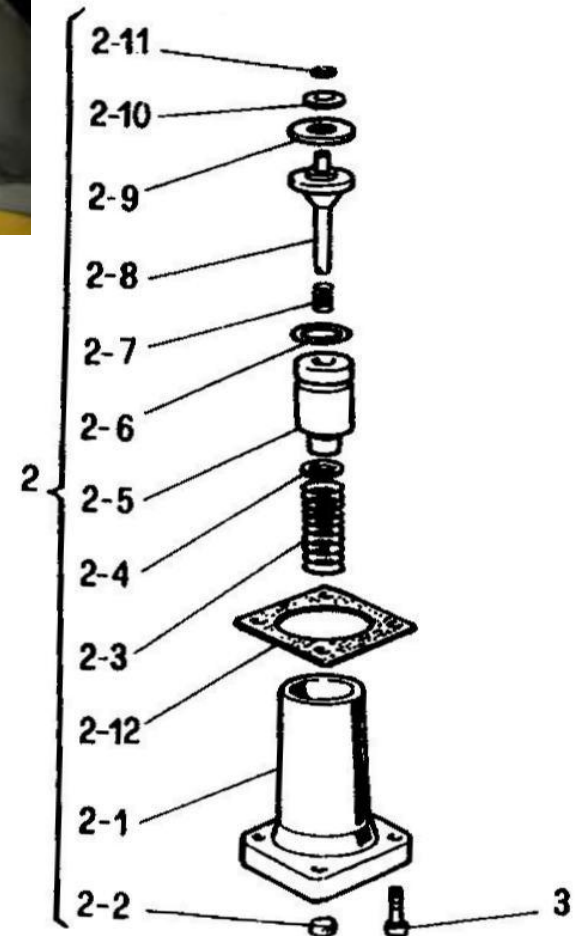


IMPORTANT :

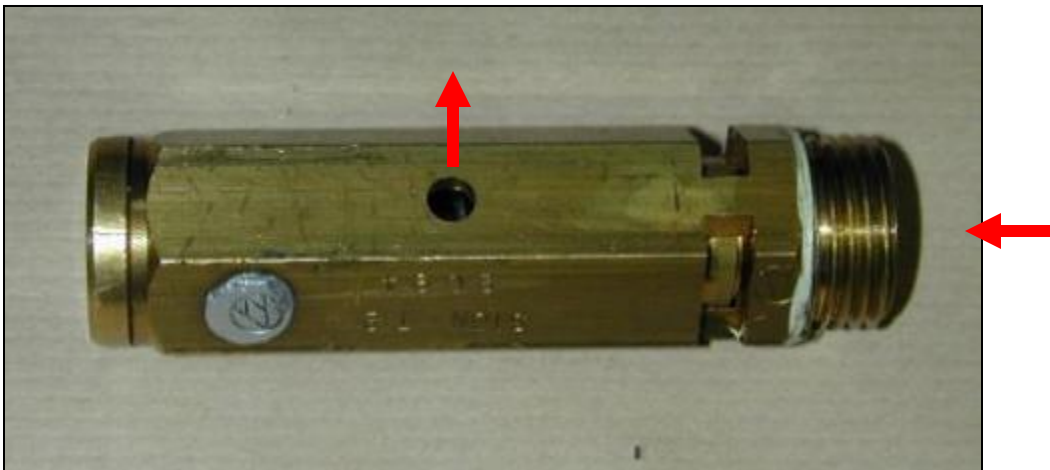
This valve keep a 5,5 bars pressure in the compressor. This pressure is very important to have a good lubrication of the rotor/stator.



Minimum pressure valve



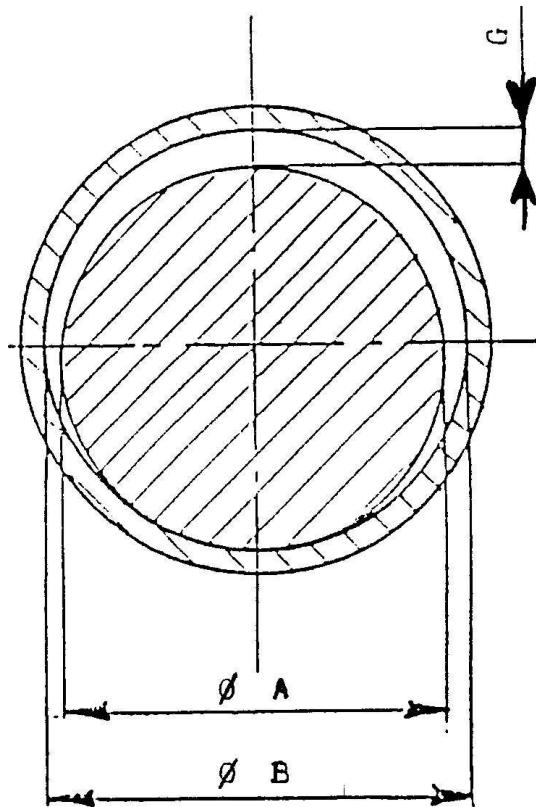
SAFETY VALVE



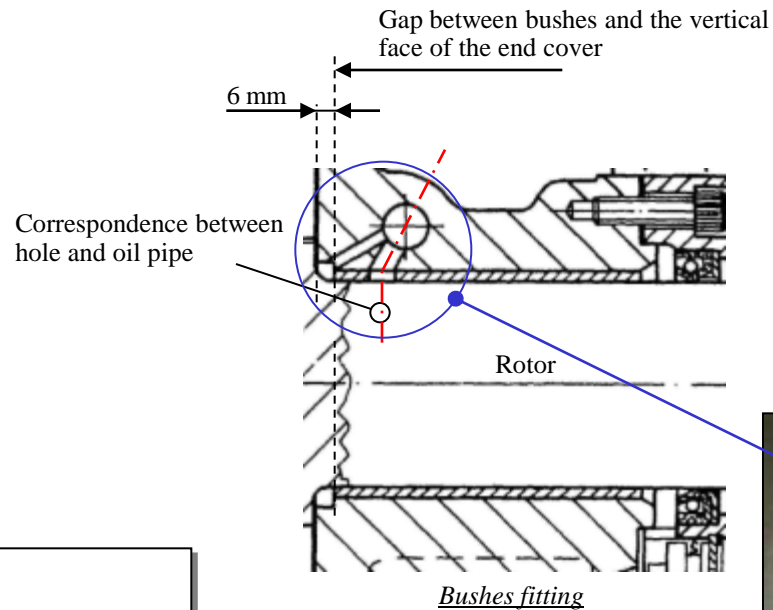
Safety valve

IMPORTANT :
The safety valve discharges oily air to the atmosphere when the pressure reaches 12 bars. If intake filters are oily check the good functioning of this valve.

SHAFT AND BUSHES



COMPRESSOR	SHAFT		BUSHES		GAP SHAFT/BUSHES
	Diameter	Roughness	Diameter	Roughness	
C178-264	A 47.955 47.980	Ra 0.4	B 48.04 48.065	Ra 0.2-0.4	G 0.060 min 0.100 maxi



IMPORTANT:

- Bushes replacement it's important to check:
- Correspondence between hole and oil pipe for lubrication.
 - The gap between bushes and the vertical face of the end covers

COUPLING

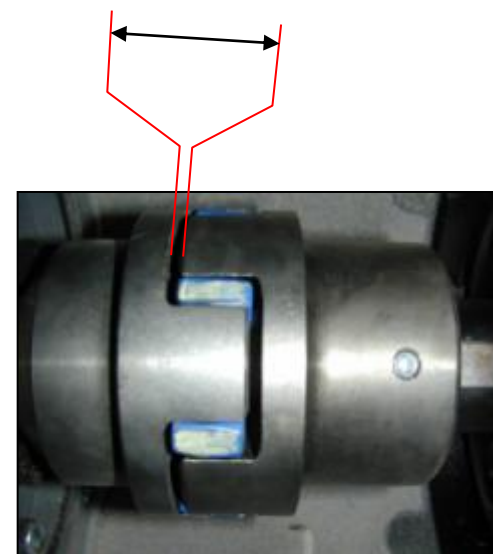
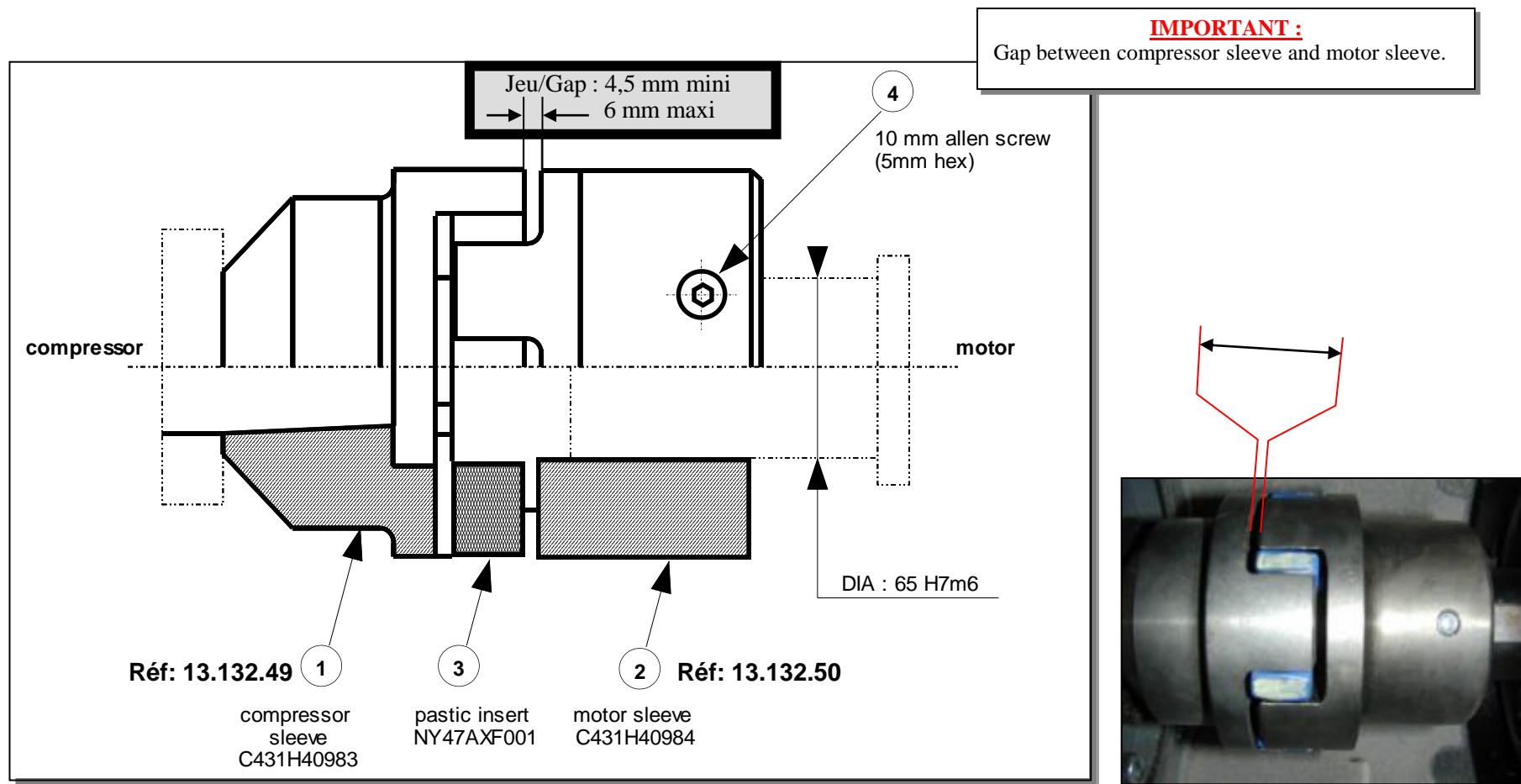
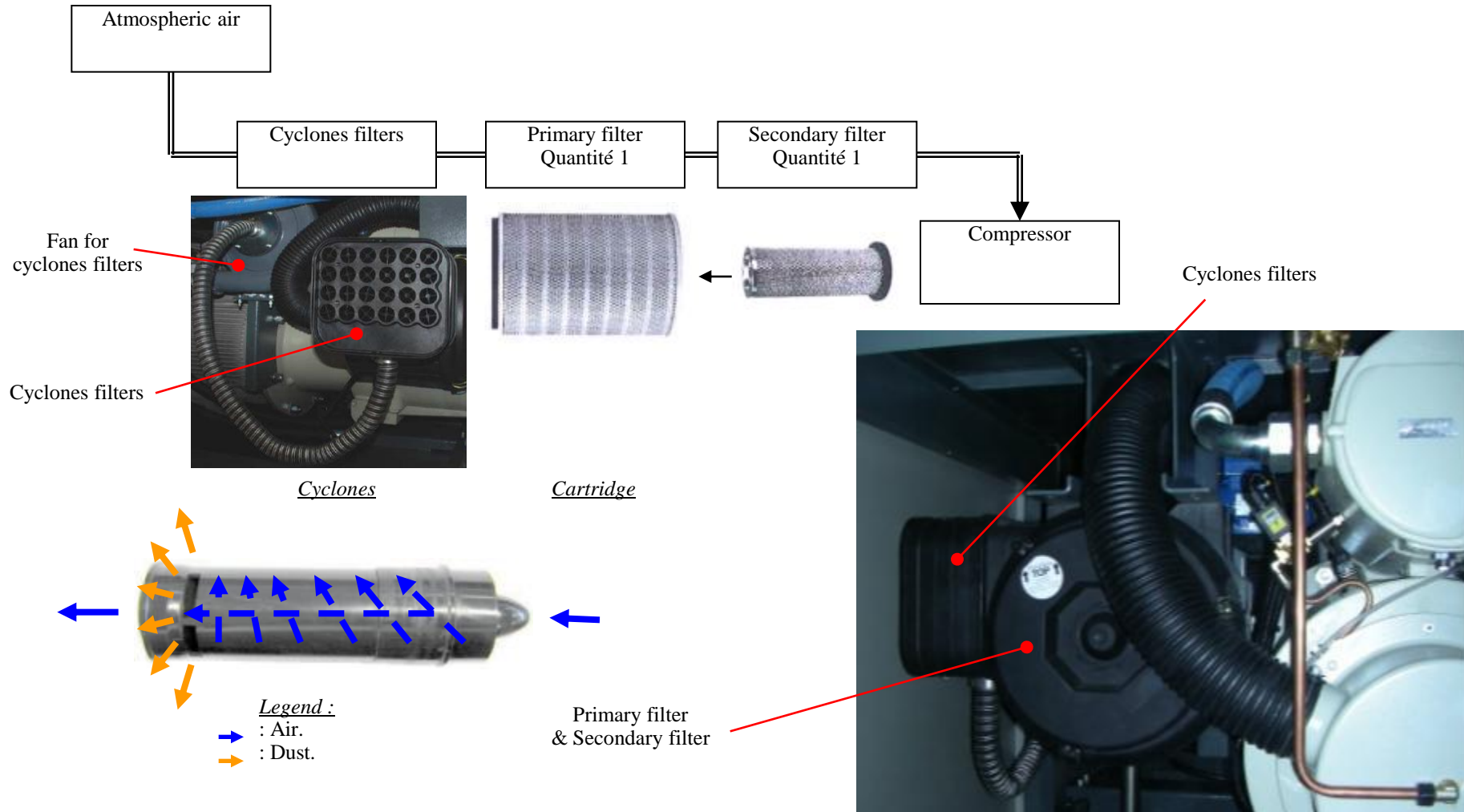


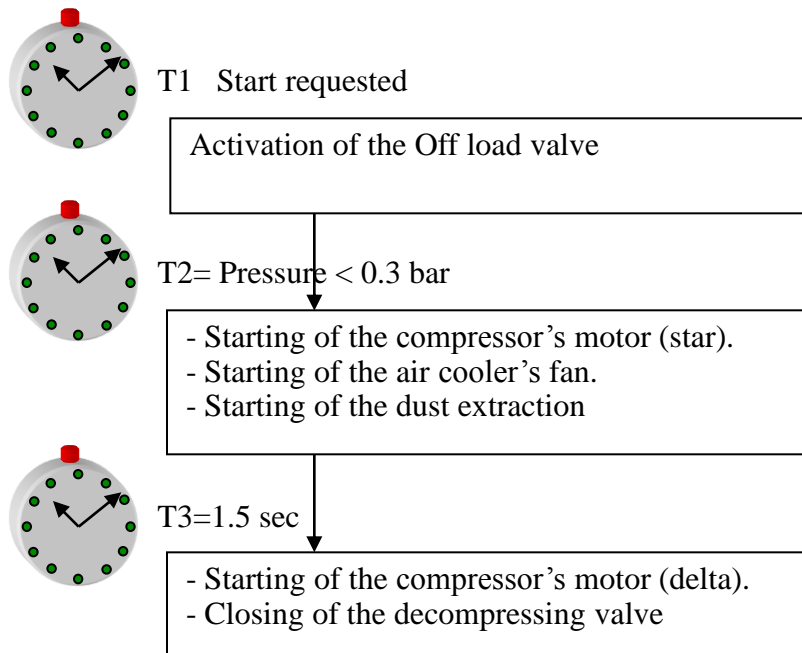
Schéma de l'accouplement / Coupling drawing

AIR INLET TREATMENT

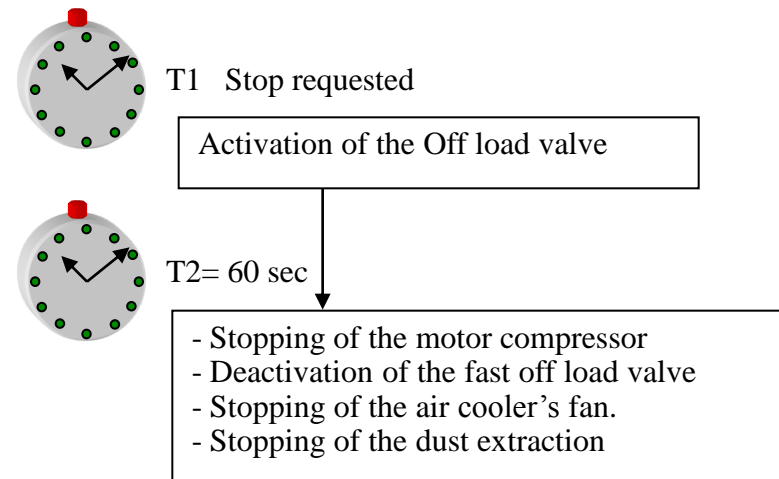


STARTING

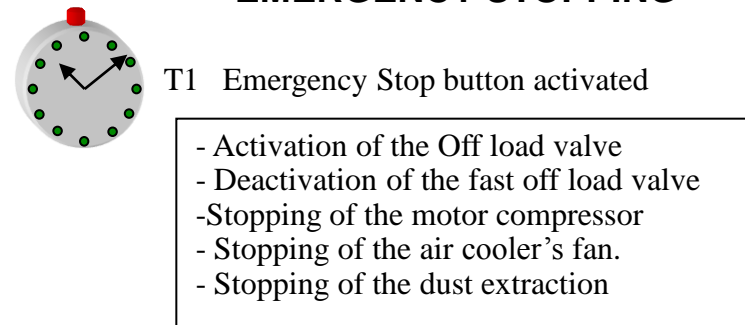
NORMAL STARTING



NORMAL STOPPING



EMERGENCY STOPPING



OIL LEVEL

- Compressor oil capacity 2 x 19 l
- First oil changing 200 hours
- Oil change frequency 1 500 hours

Oil filter



Oil filling point

Oil filling filter

Compressor stopped

Oil max level

Compressor running

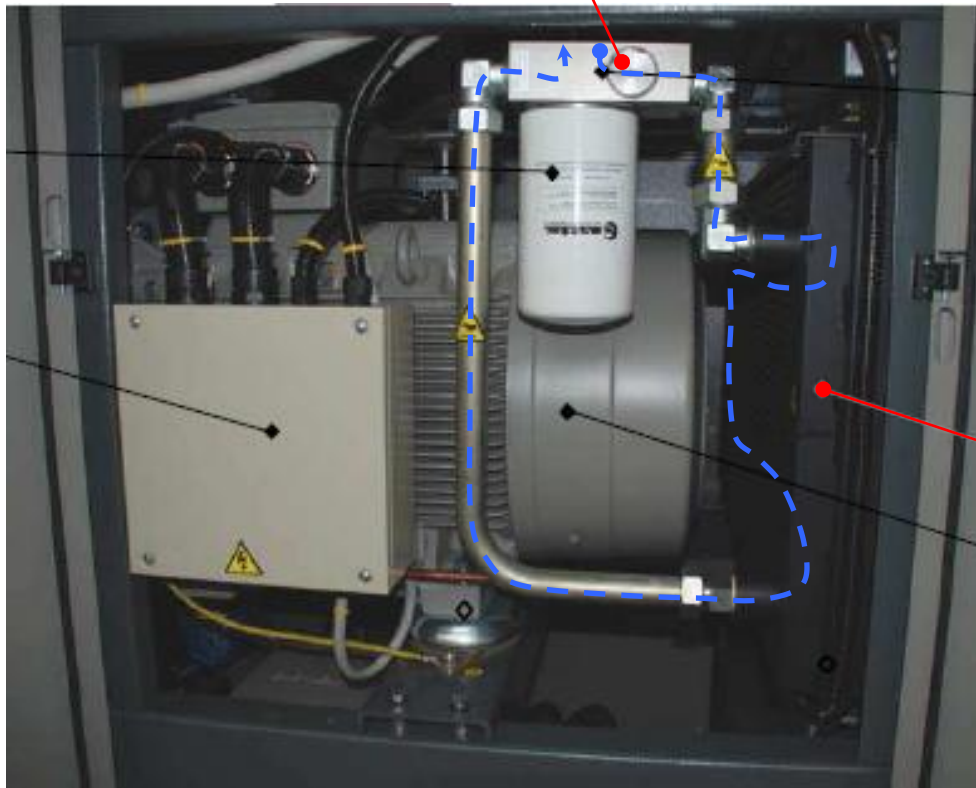
For oil filling
Maxi level

OIL COOLING

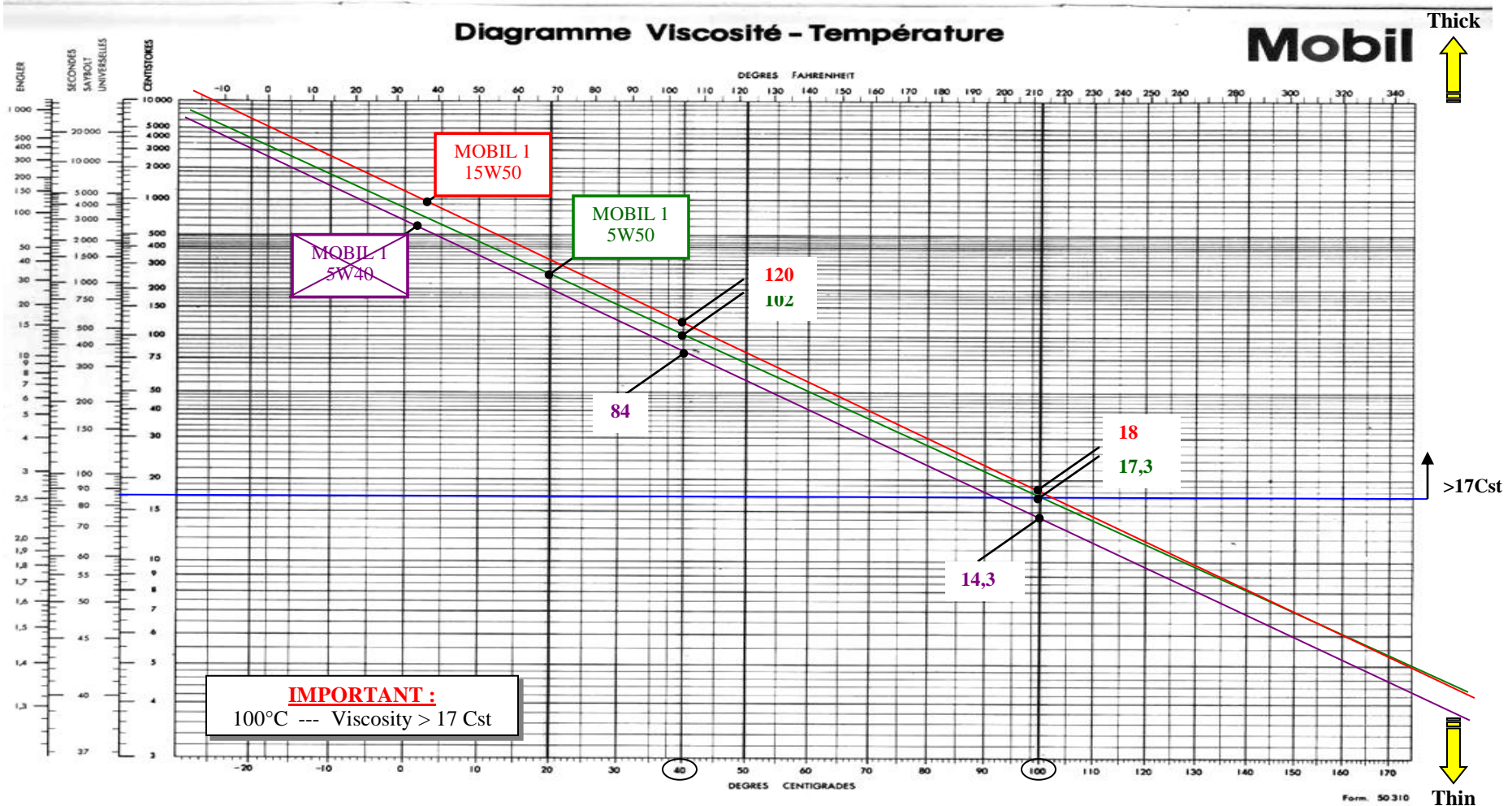
Thermostat bulb (82°C)

Oil cooler fan

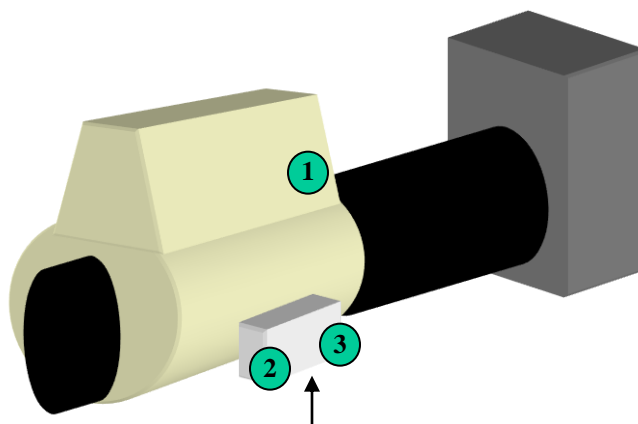
Oil cooler radiator



OIL



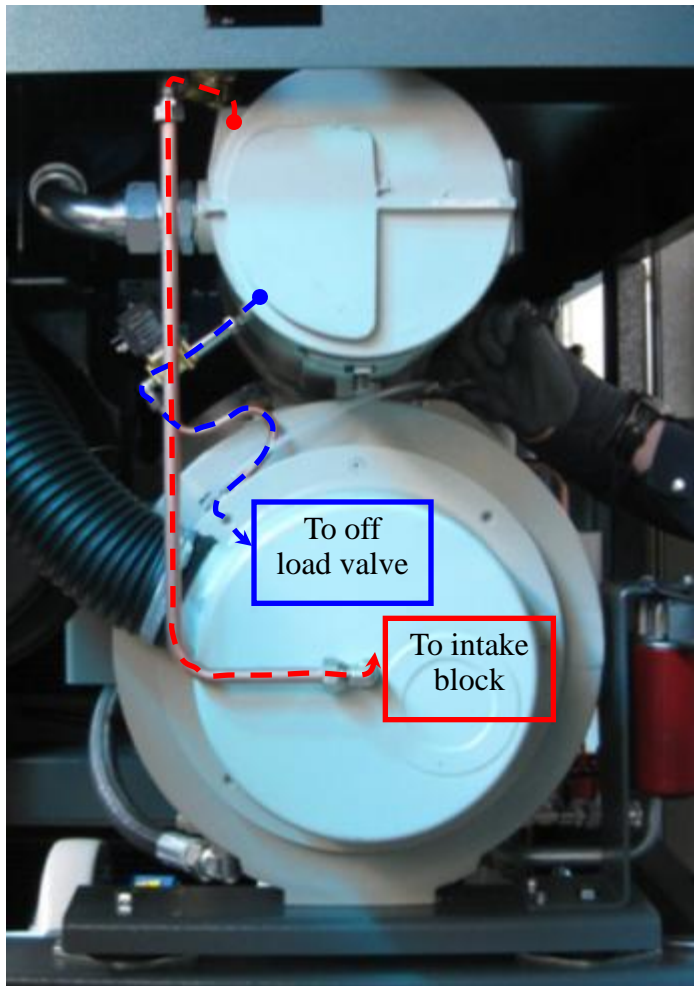
THERMIC CONTROL



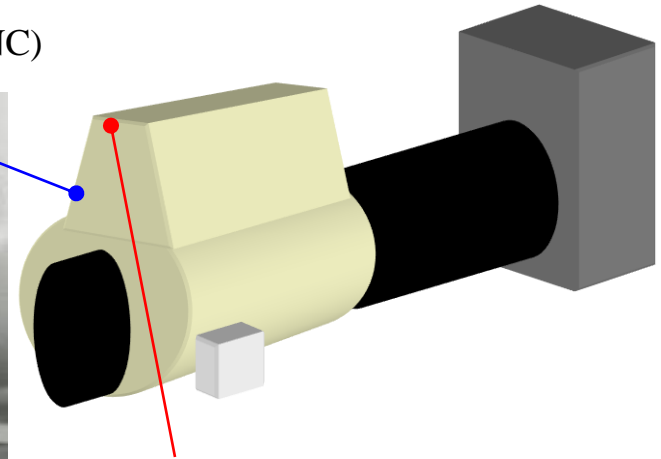
N°	Localisation / Localisation	Electrical Rep	T°C	Fonction / Function
1	Séparateur air huile / Air oil separator	A1.8 / A2.8	135	- Sonde sécurité / Security sensor - Arrête le compresseur / Stop the compressor
2	Carter d'huile/ Oil Compressor housing	A1.7 / A2.7	115<x <5	- Arrête le compresseur / Stop the compressor
3	Carter d'huile (vertic.)/ Oil housing (vertic.)	A1.7 / A2.7	105	- Alerte haute T°C huile / High oil T°C - Alerte reportée en cabine / Message reported in the cabin



OFF LOAD VALVE



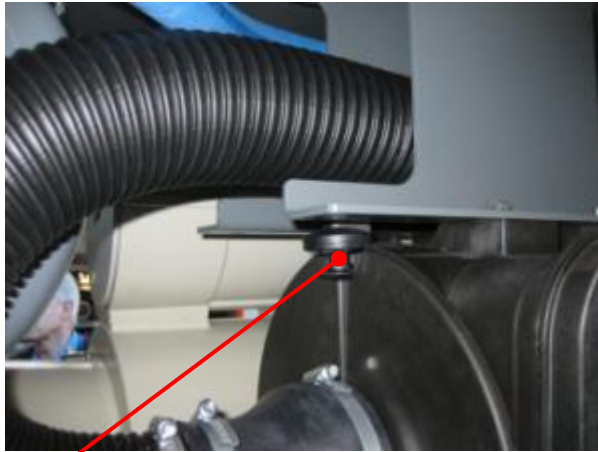
Off load solenoid valve (NC)



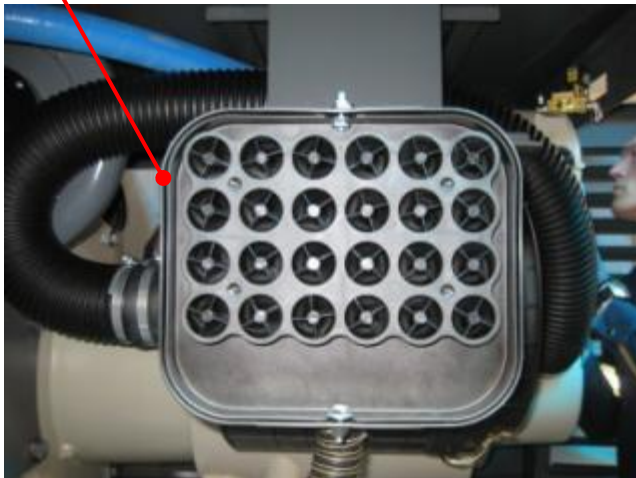
Fast off load solenoid valve (NO)



FILTER & AIR PRESSURE CONTROL

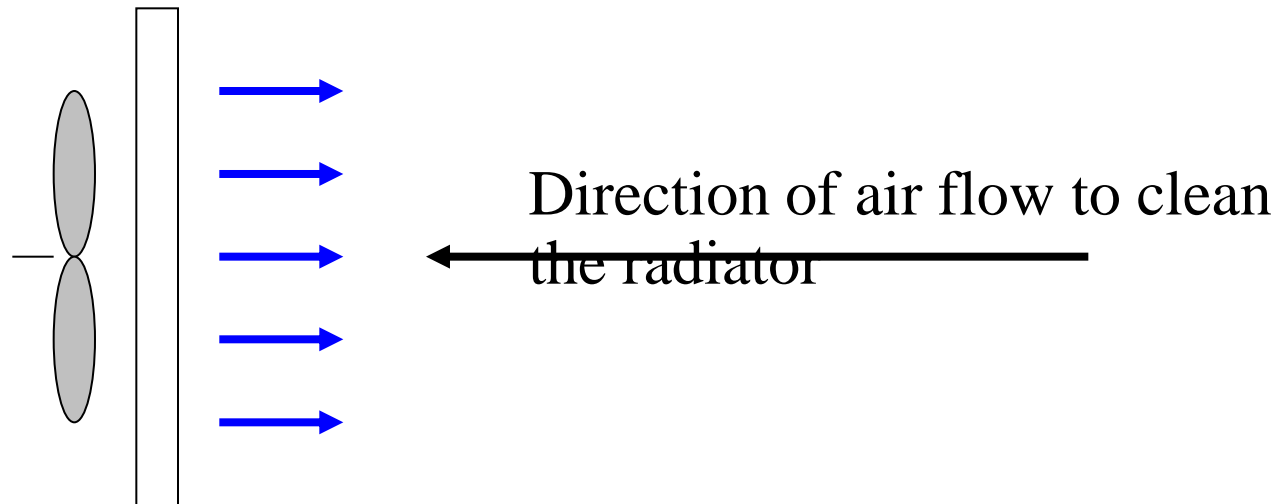


Inlet filter clogged sensor



Air pressure detection (5.5 bar)

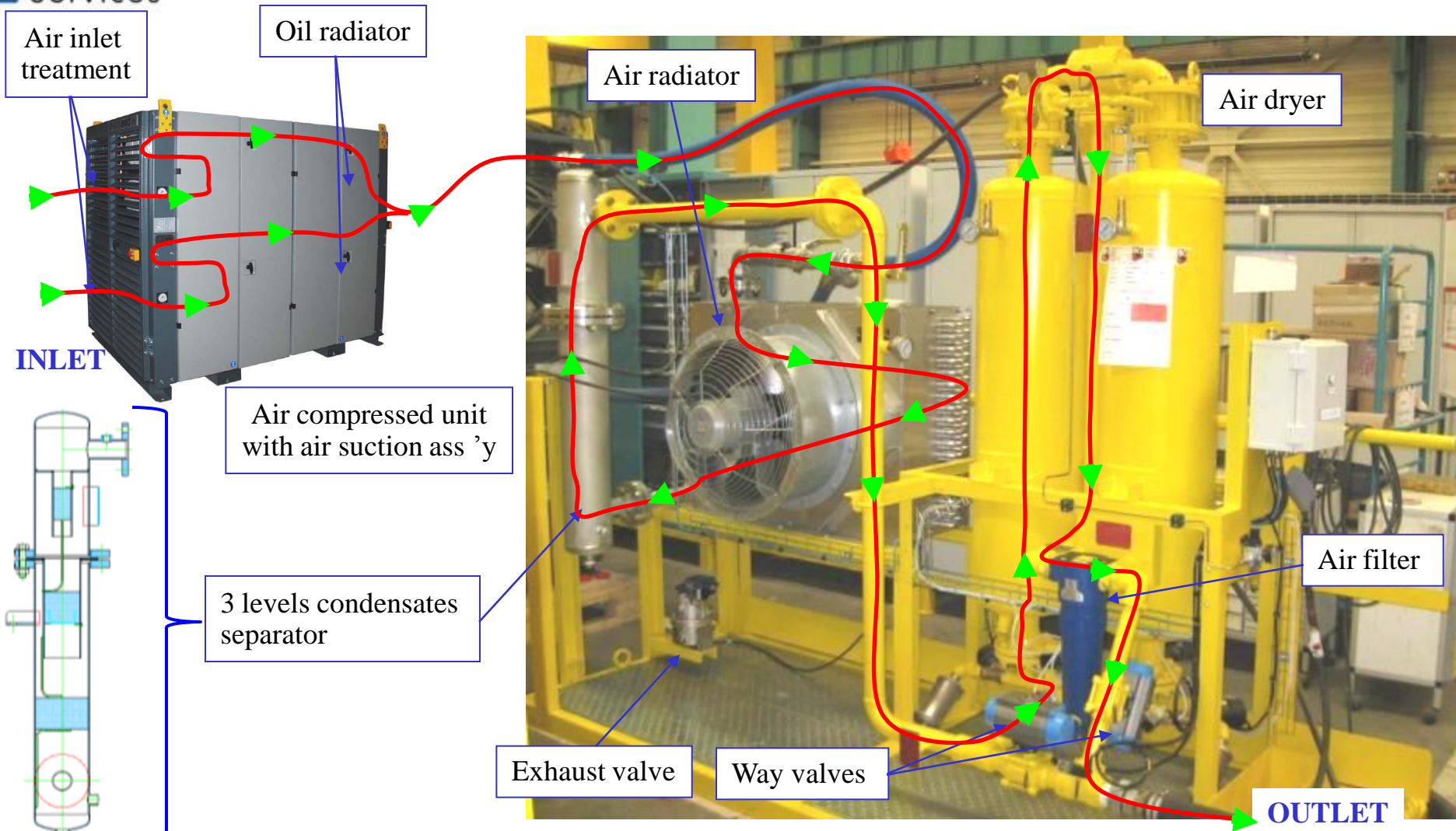
RADIATOR CLEANING



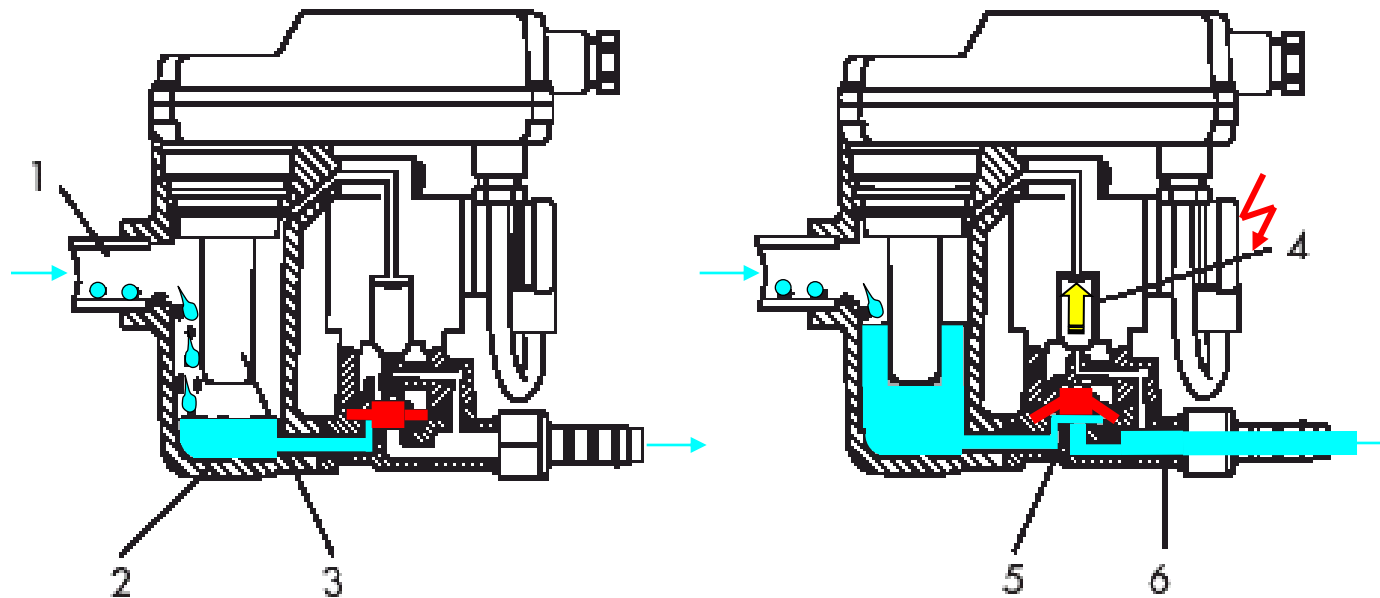
Legend :

- : Direction of air flow to clean the radiator
→ : Air flow of the fan.

AIR COMPRESSOR UNIT (Type MS 880 L ECL – 14 700 l/mn – 7.5 bars)

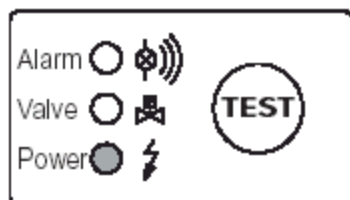


CAPACITY DRAIN VALVE BEKOMAT

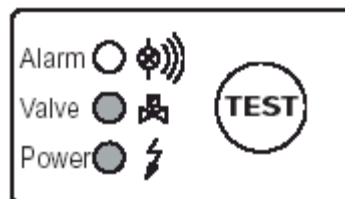


- 1 Inlet line
- 2 Tank
- 3 Capacity sensor
- 4 Pilot valve
- 5 Diaphragm
- 6 Outlet line

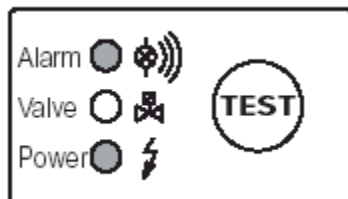
CAPACITY DRAIN VALVE BEKOMAT



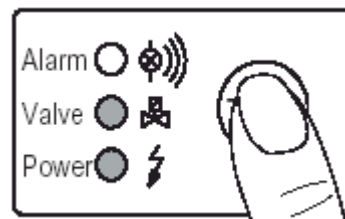
Ready for opération



Evacuation to outlet line



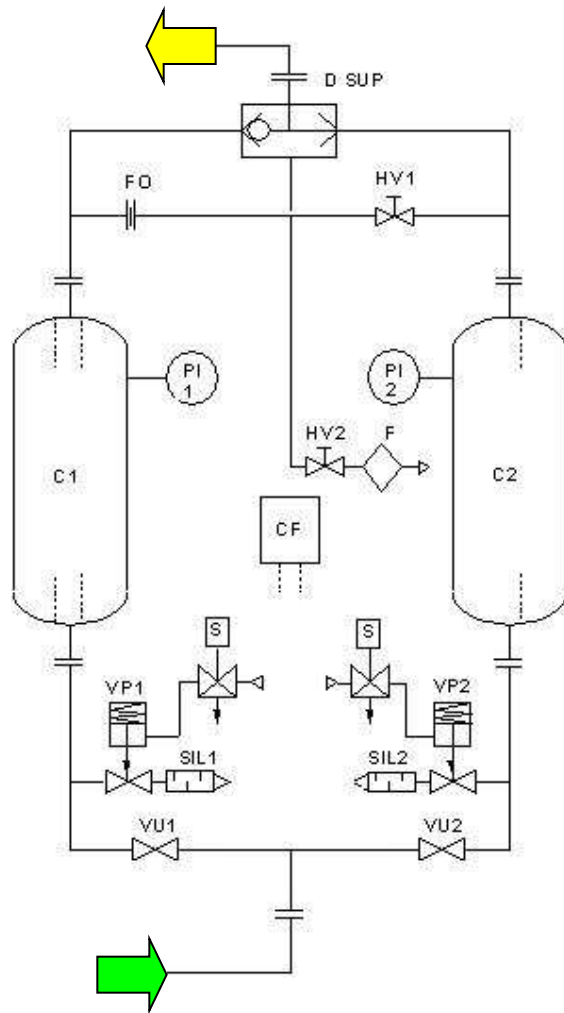
Alarm. Valve in fault



Manuel evacuation order



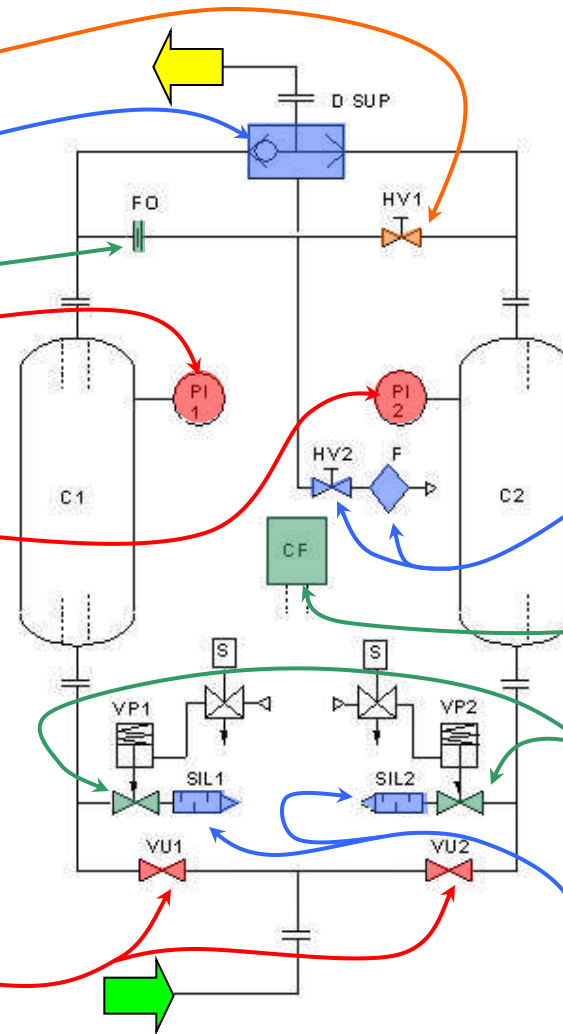
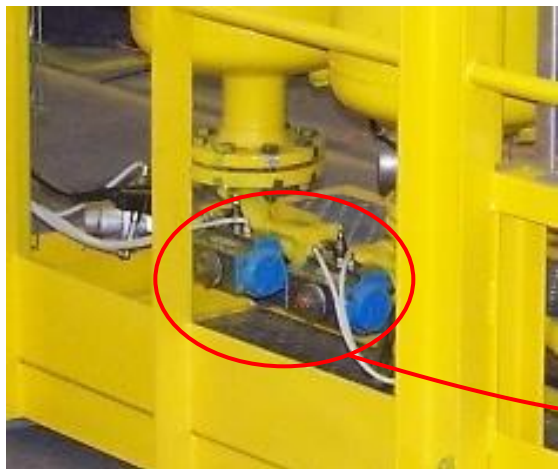
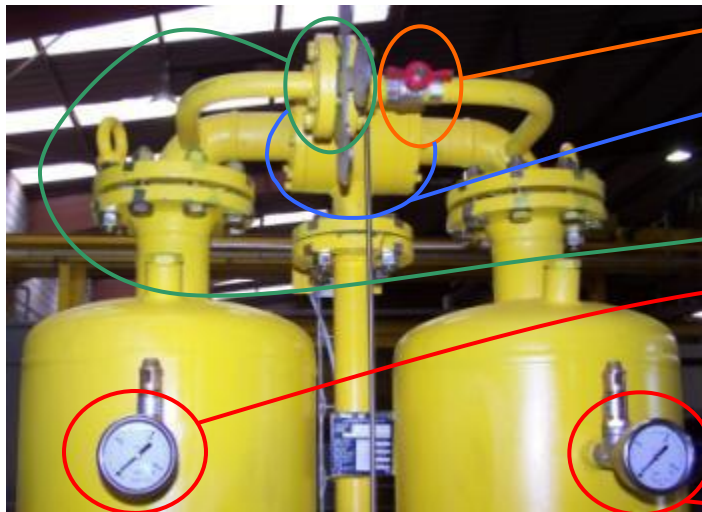
AIR DRYER



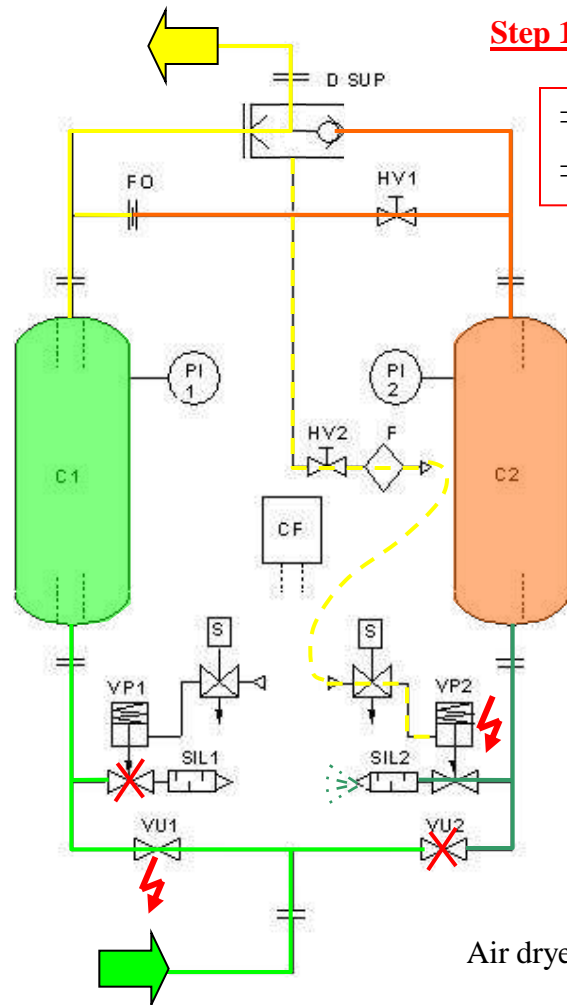
- C1 Drying column
- C2 Drying column
- D SUP Change over valve
- HV1 Manual valve
- FO Calibrate hole
- VU1 Distributor valve
- VU2 Distributor valve
- PI1 Pressure gauge
- PI2 Pressure gauge
- VP1 Drain pneu valve
- VP2 Drain pneu valve
- HV2 Pilot air valve
- F Air filter
- SIL1 Exhaust silencer
- SIL2 Exhaust silencer
- CF Electric box
- S Control valve



AIR DRYER



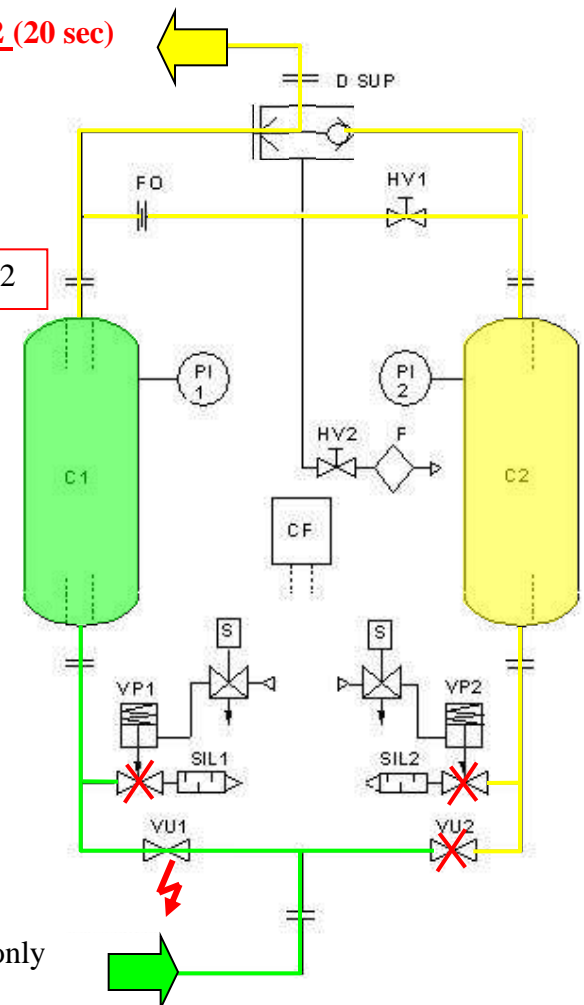
AIR DRYER



Step 1 (40 sec)

⇒ Drying by C1
⇒ Cleaning of C2

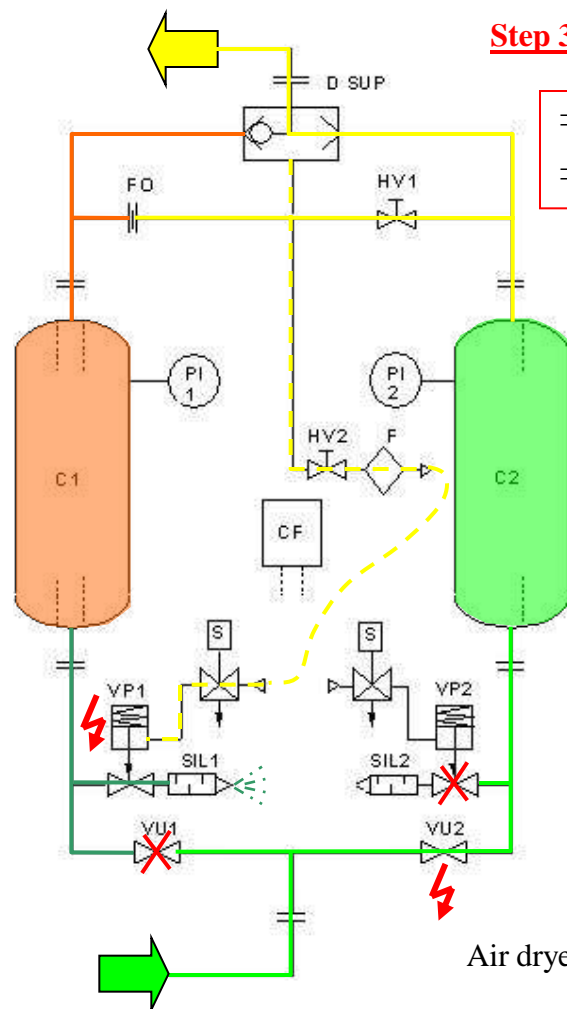
⇒ Pressurization of C2



Step 2 (20 sec)

Air dryer by-pass during metal tapping operation only

AIR DRYER

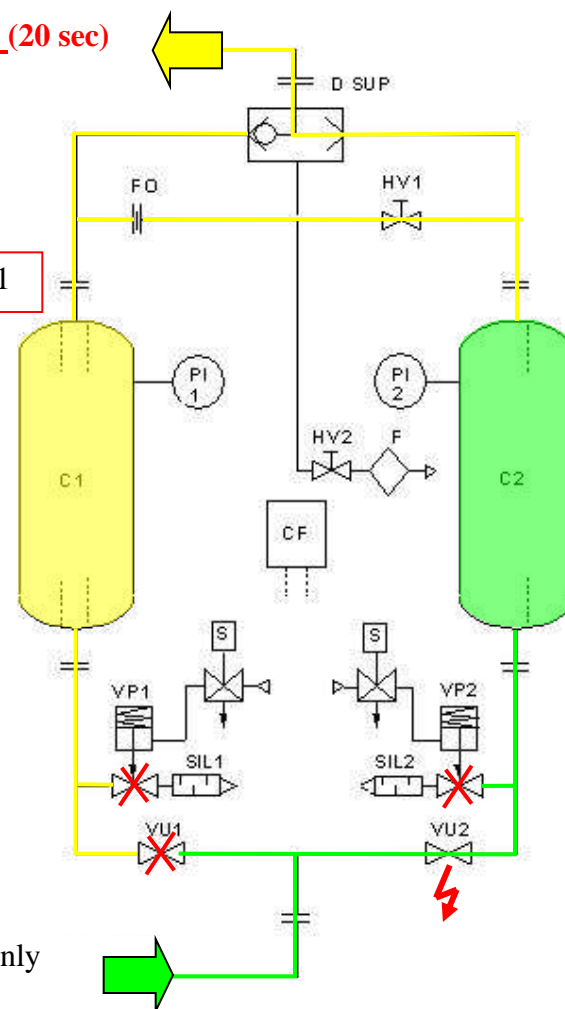


Step 3 (40 sec)

⇒ Drying by C2
⇒ Cleaning of C1

⇒ Pressurization of C1

Air dryer by-pass during metal tapping operation only

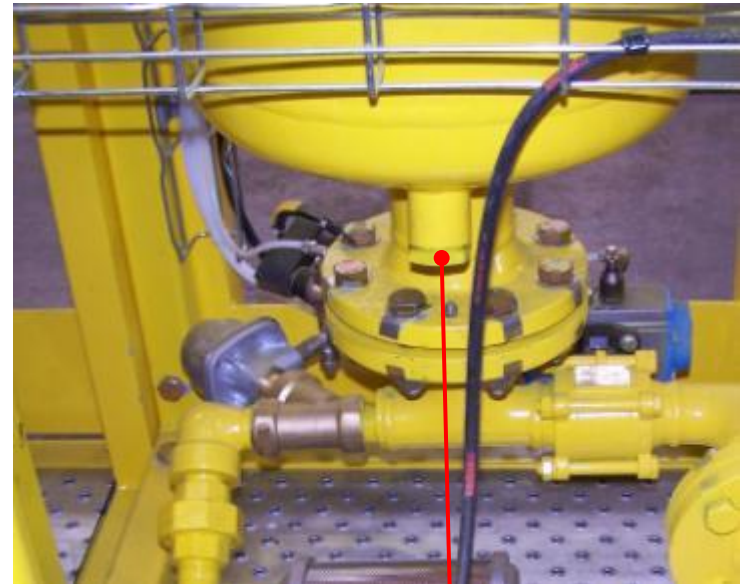


Step 4 (20 sec)

⇒ Pressurization of C1

AIR DRYER DESICCANT REPLACEMENT

Filling plug on top of the
vessel



Draining plug at the
bottom of the vessel



<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

**THANK YOU FOR YOUR
ATTENTION**

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MA'ADEN PROJECT

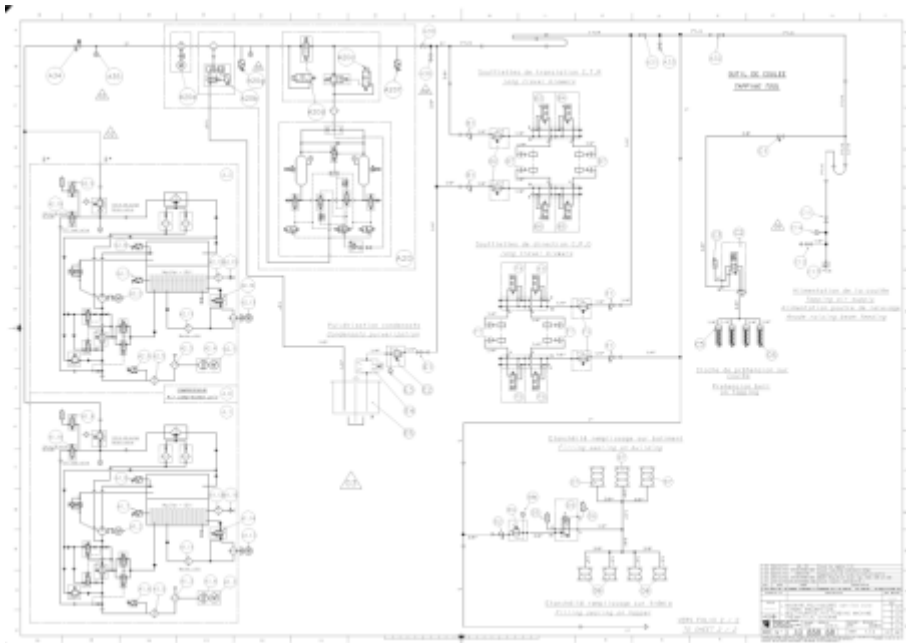
P1034 - PTM

POT TENDING MACHINE

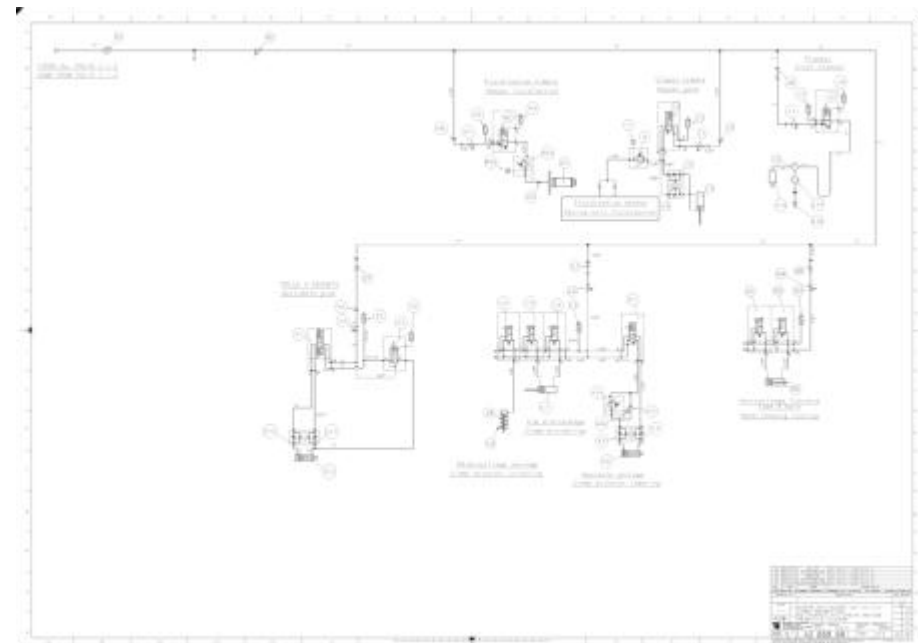
Pneumatic diagram

PNEUMATIC SCHEMATIC

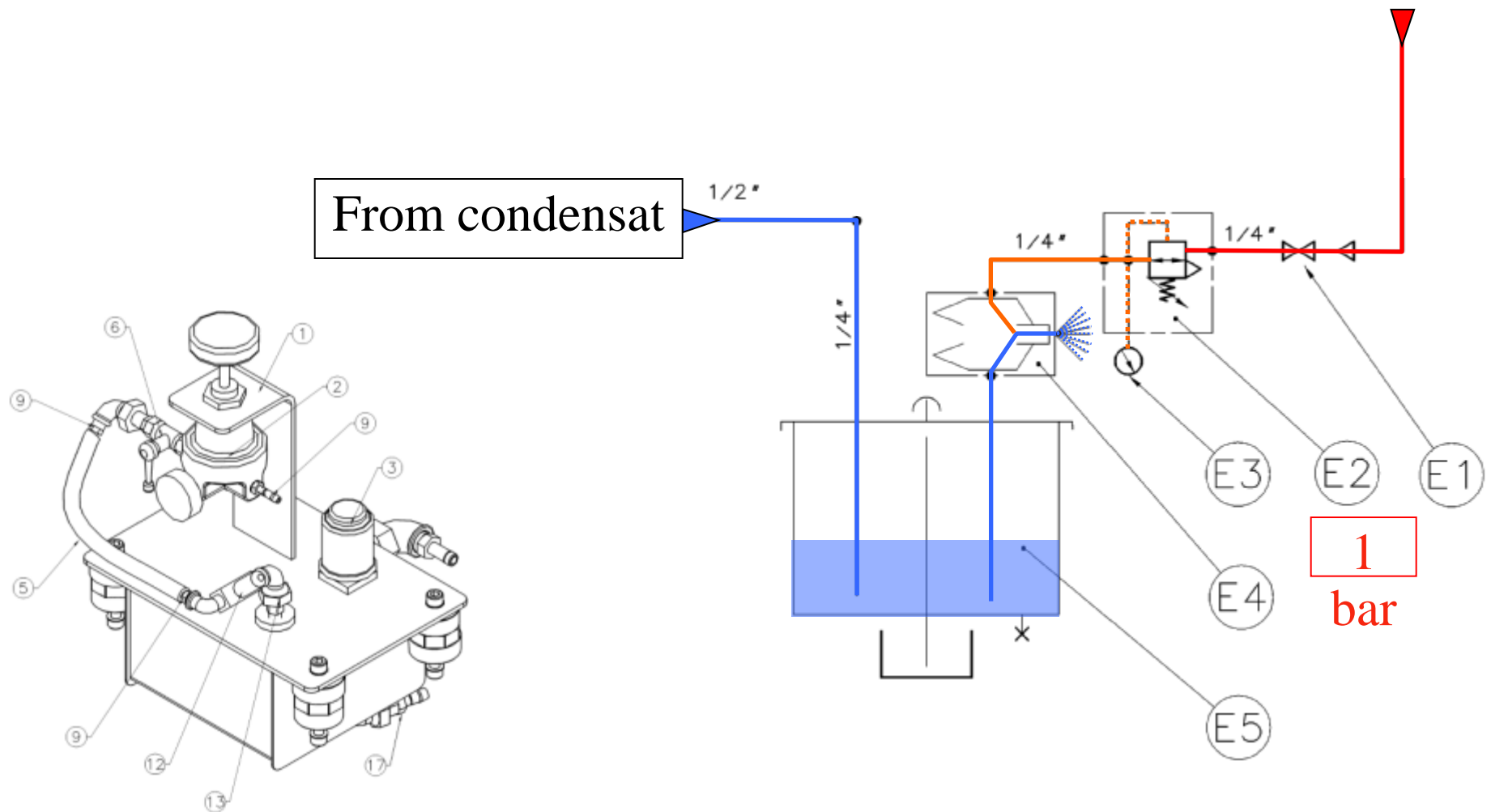
FOLIO 1



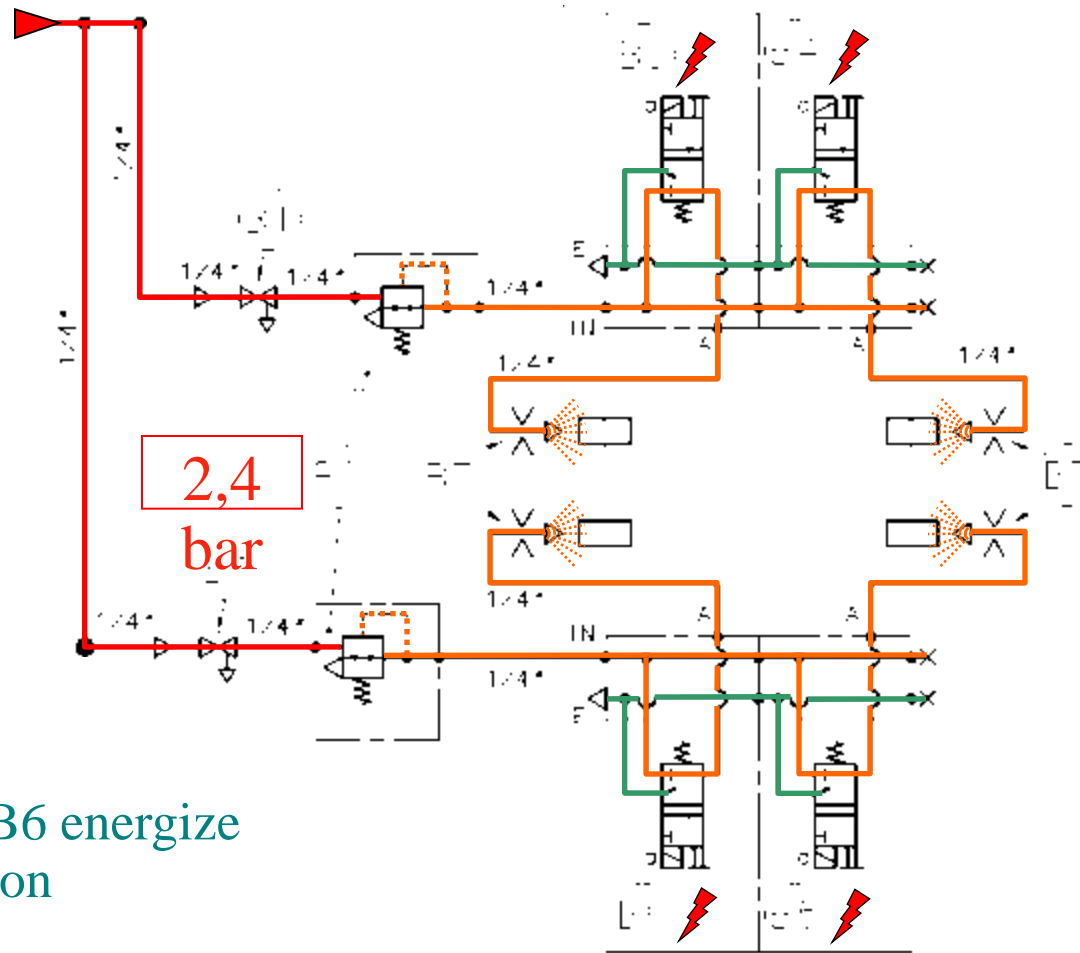
FOLIO 2



A/C & Condensat pulverization

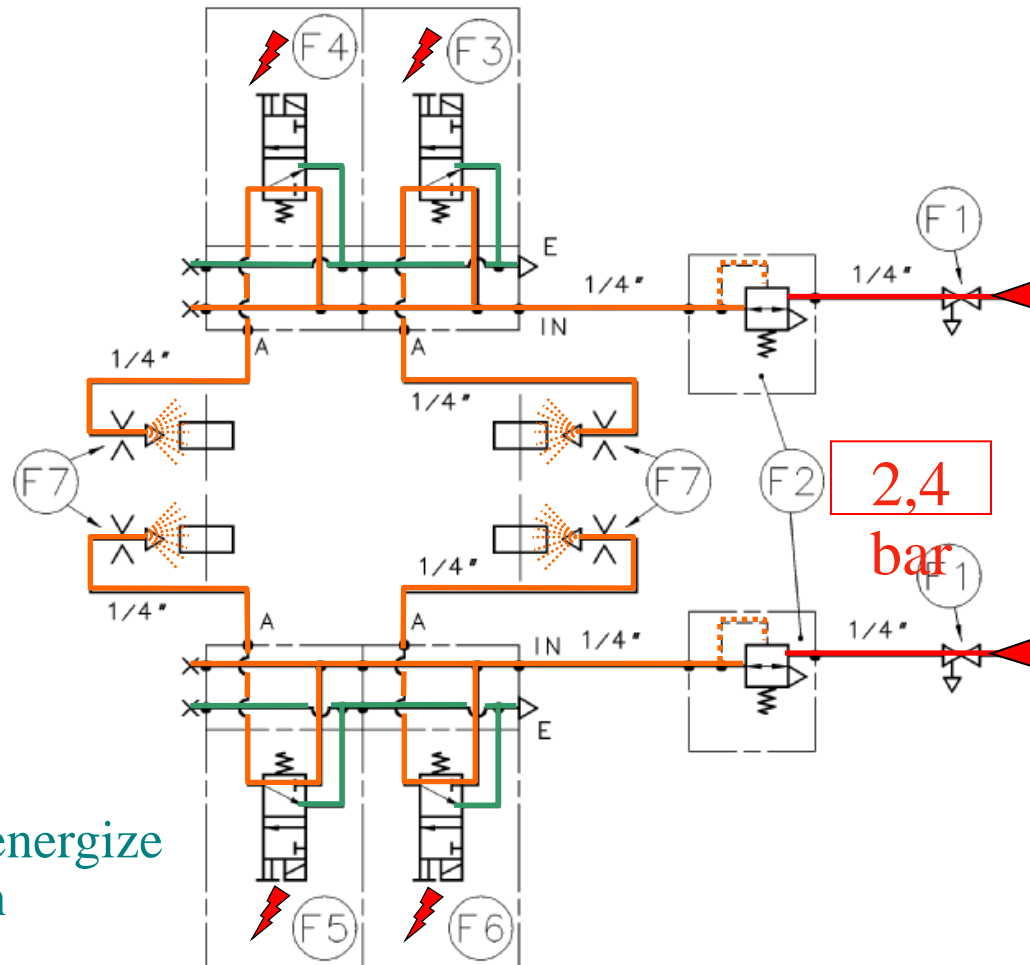


Long travel blowers



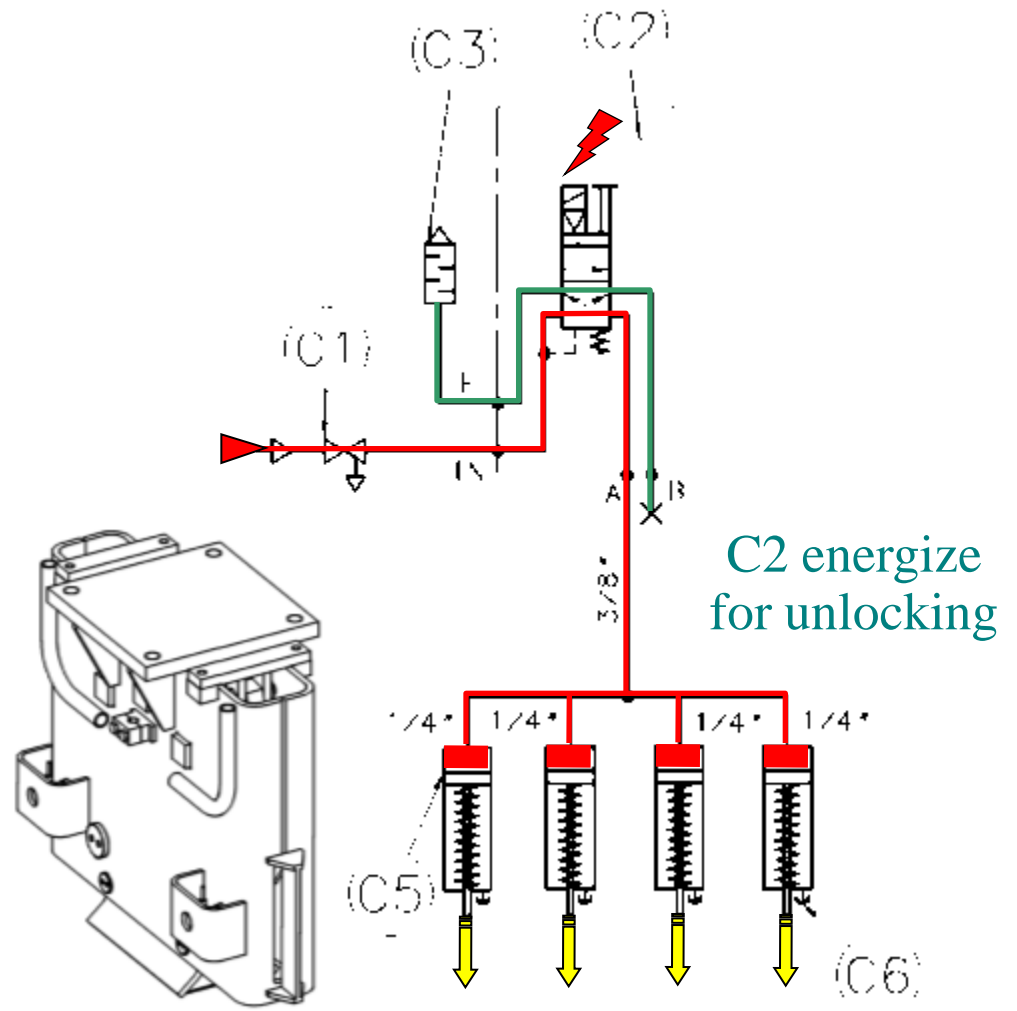
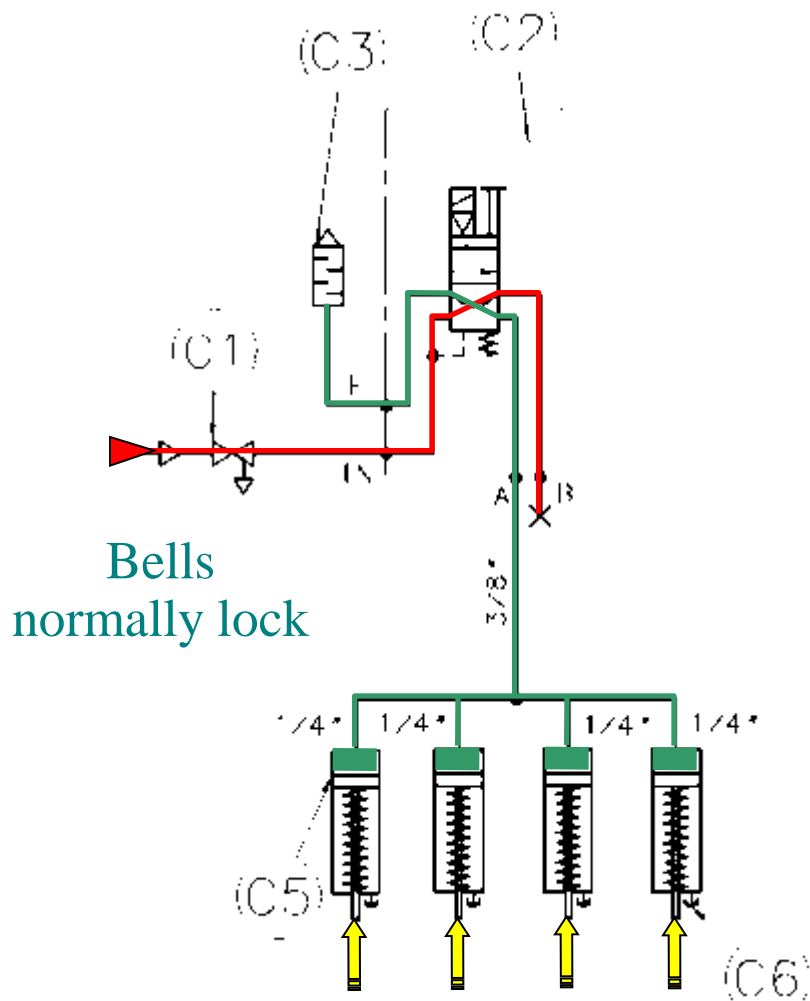
B3, B4, B5 & B6 energize
during LT motion

Cross travel blowers

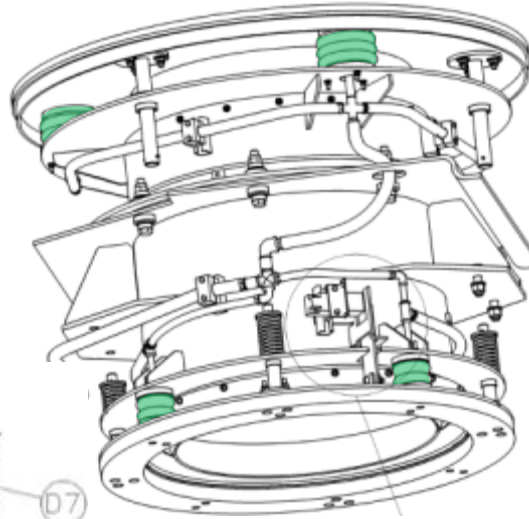


F3, F4, F5 & F6 energize
during CT motion

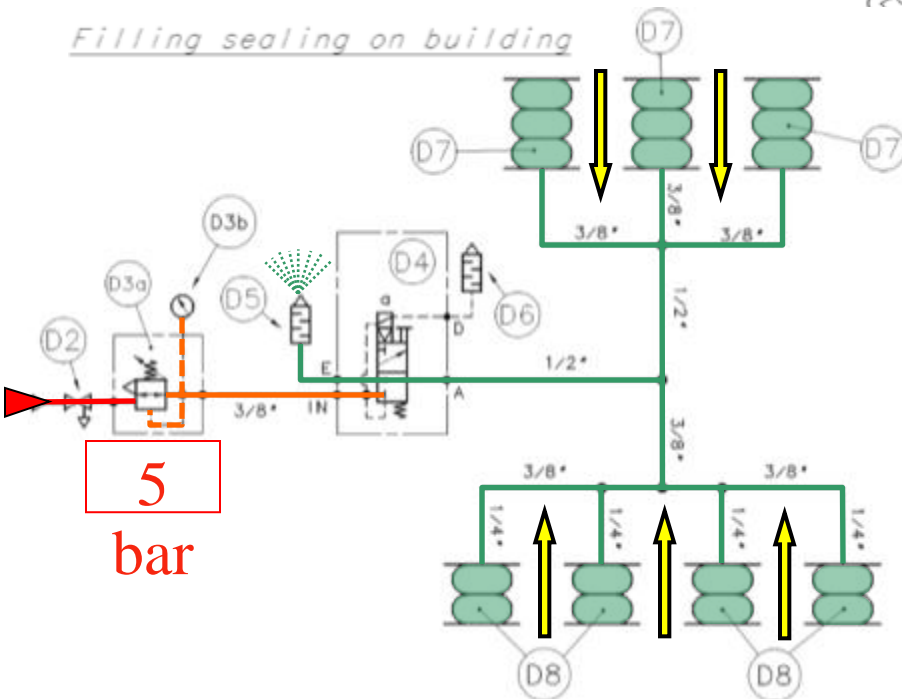
Hooking bells on tapping



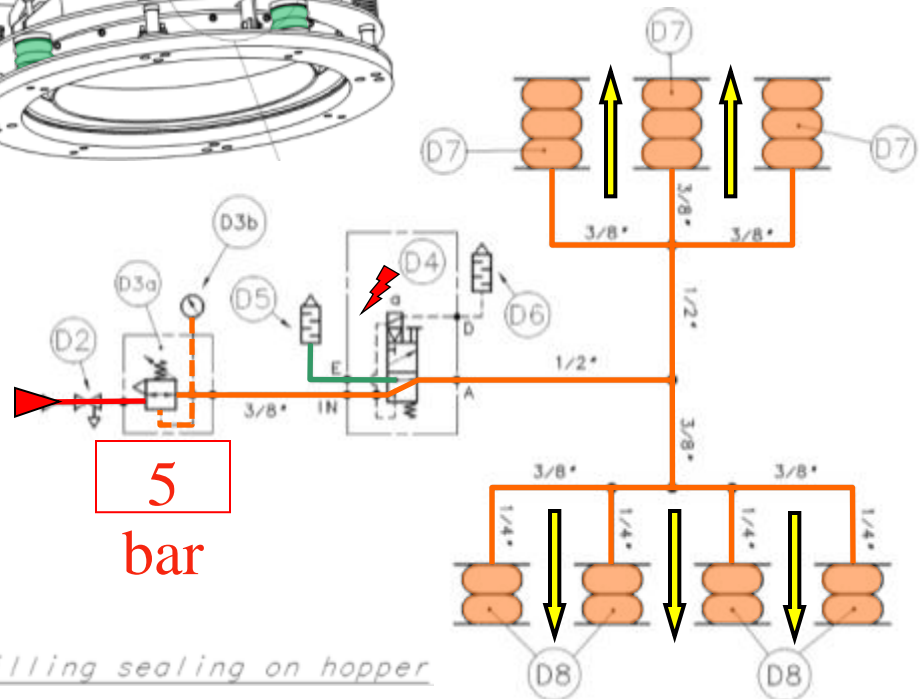
Hopper filling



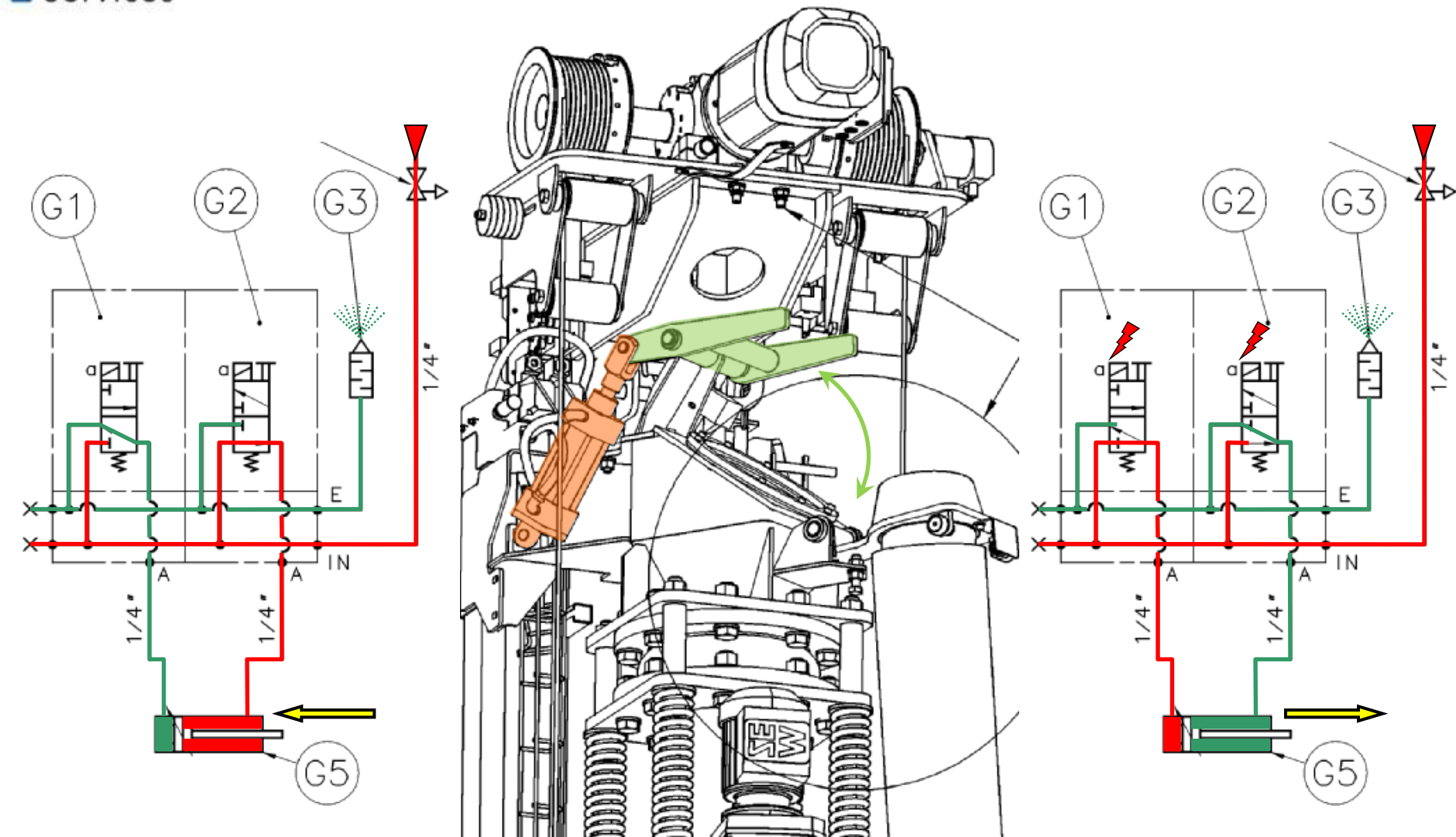
Filling sealing on building



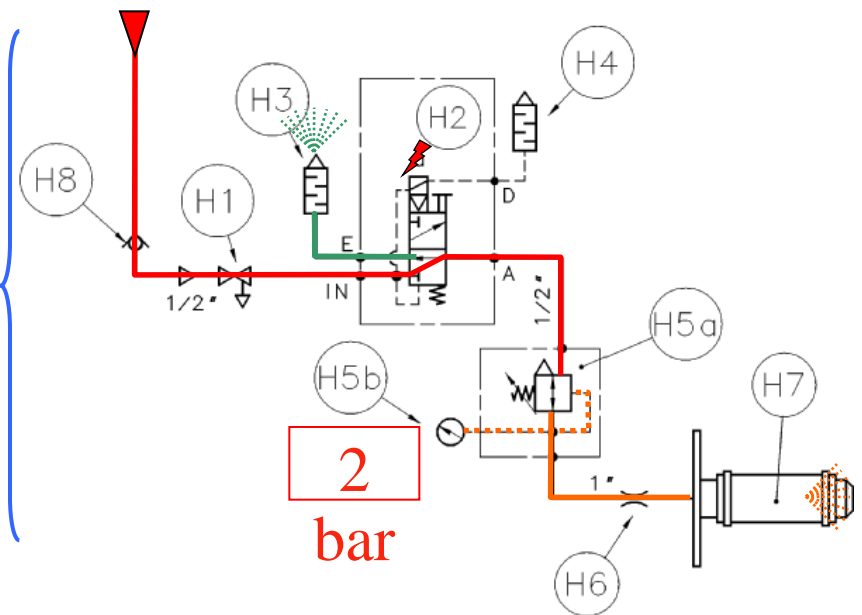
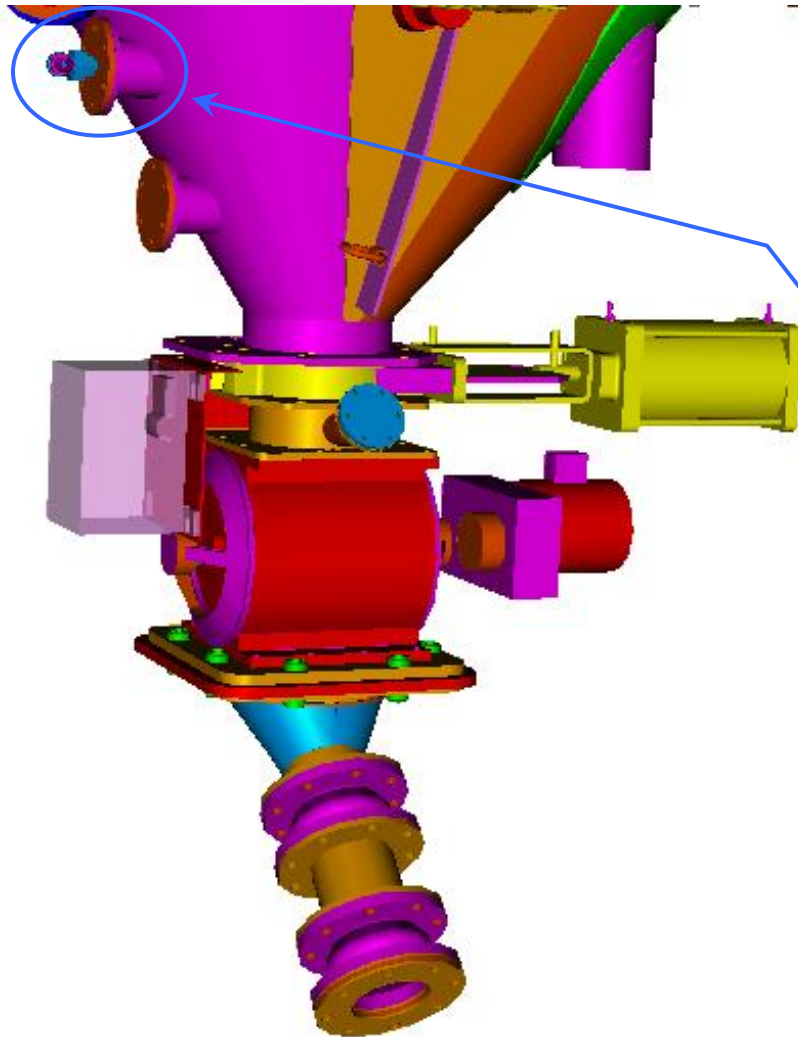
Filling sealing on hopper



Bath feeding locking

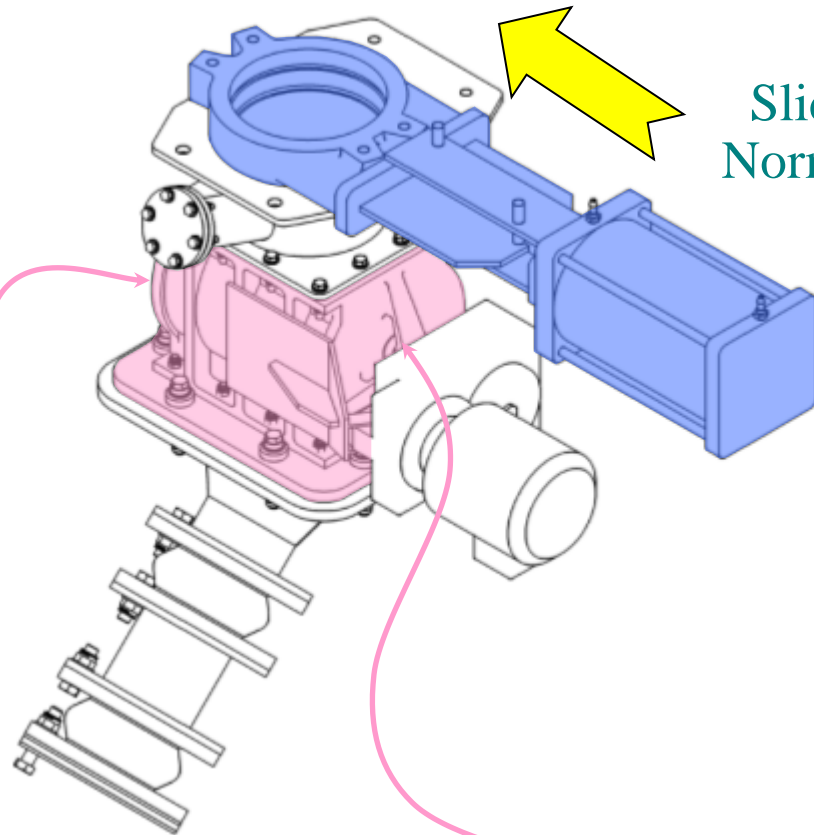


Hopper fluidization

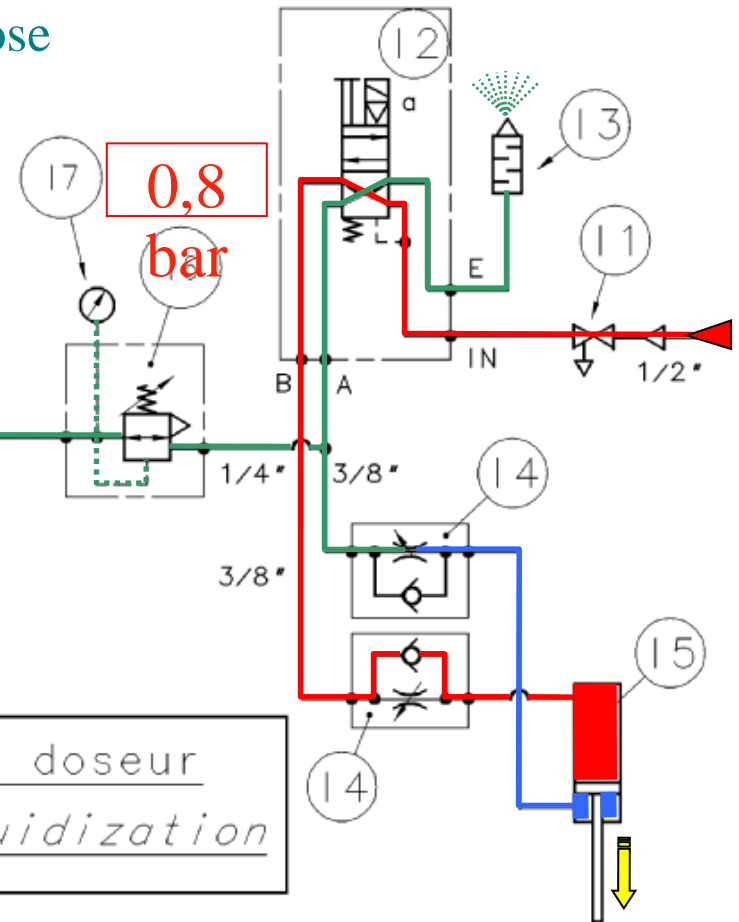


Hopper gate

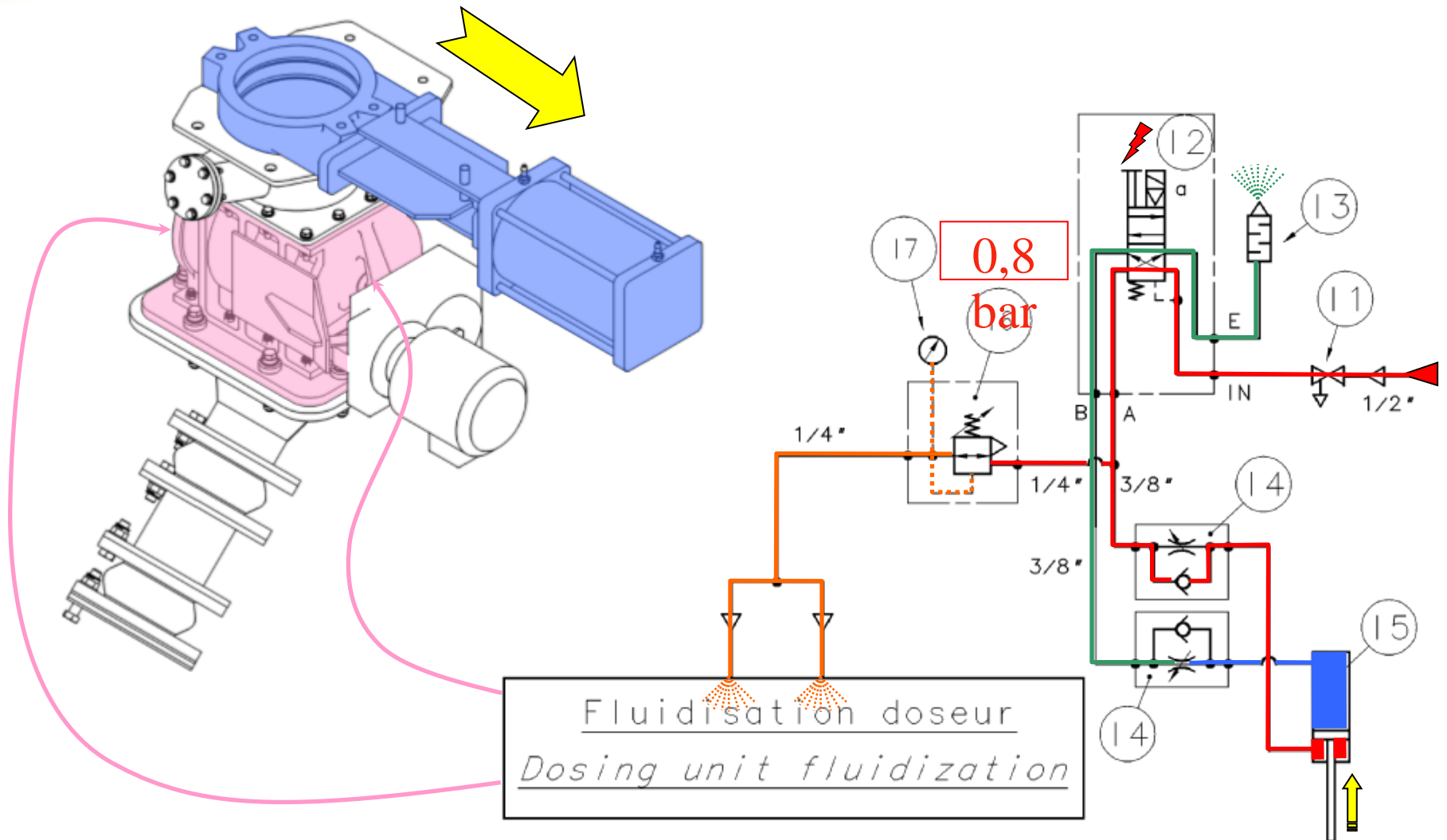
Sliding valve
Normally Close



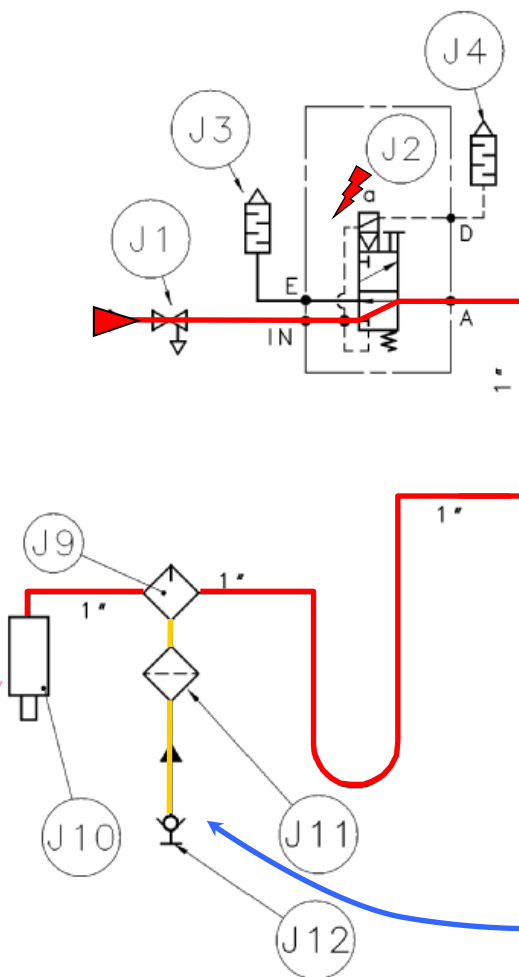
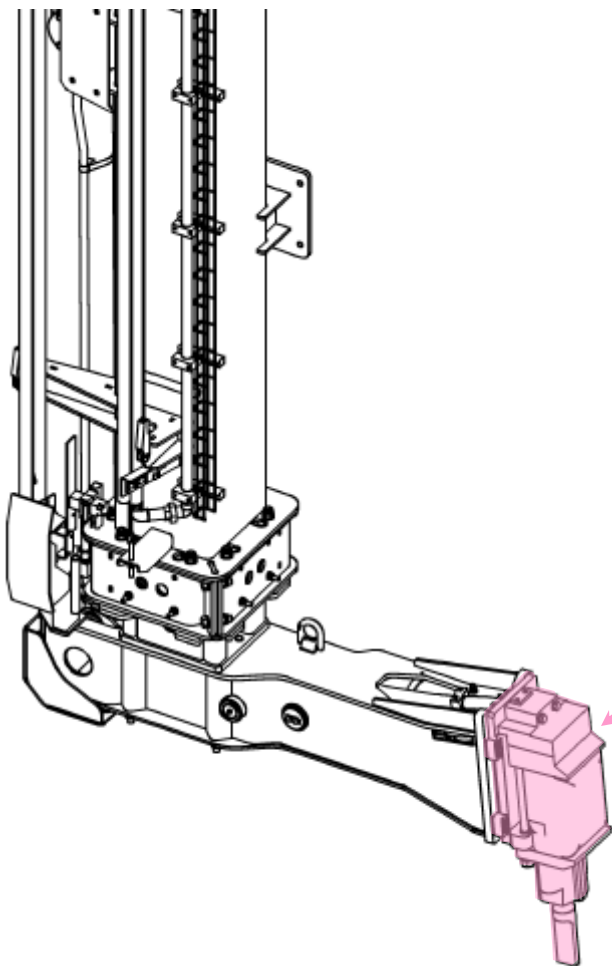
Fluidisation doseur
Dosing unit fluidization



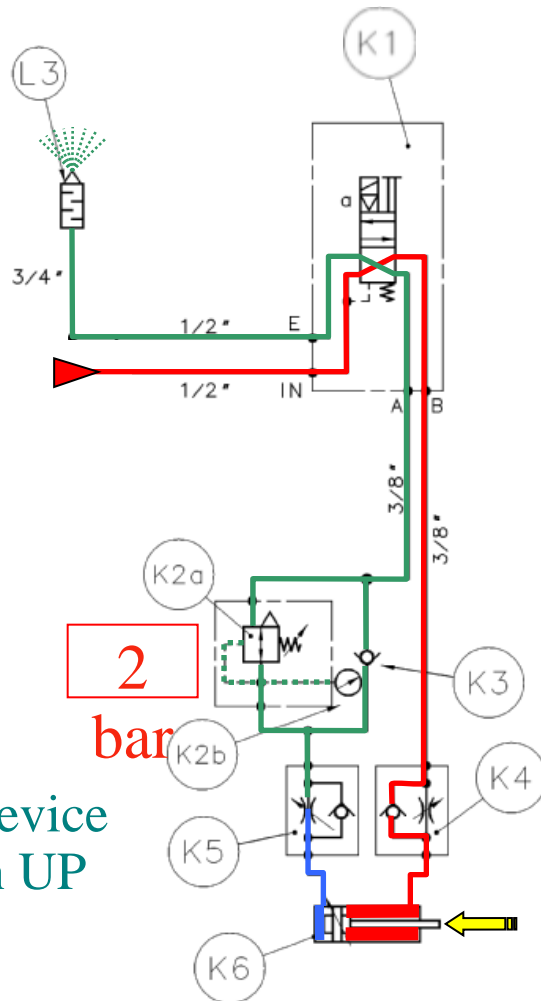
Hopper gate



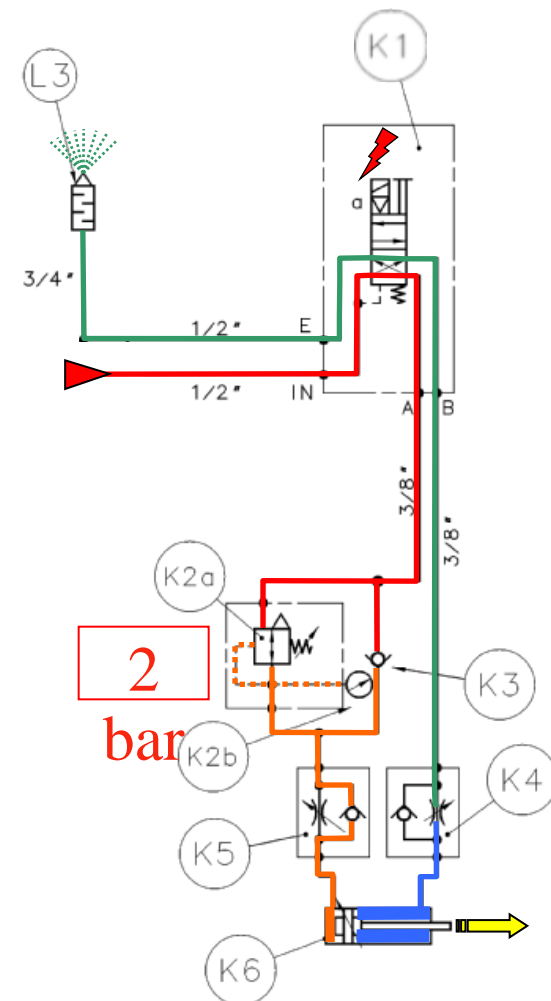
Crust breaker



Tightening device lowering

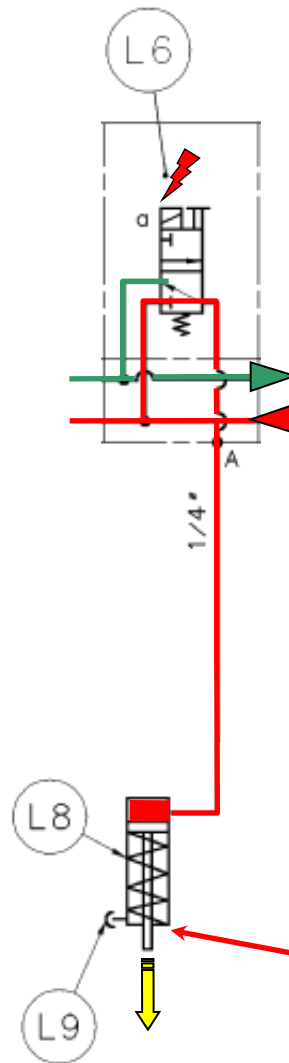


Tightening device
Normally in UP

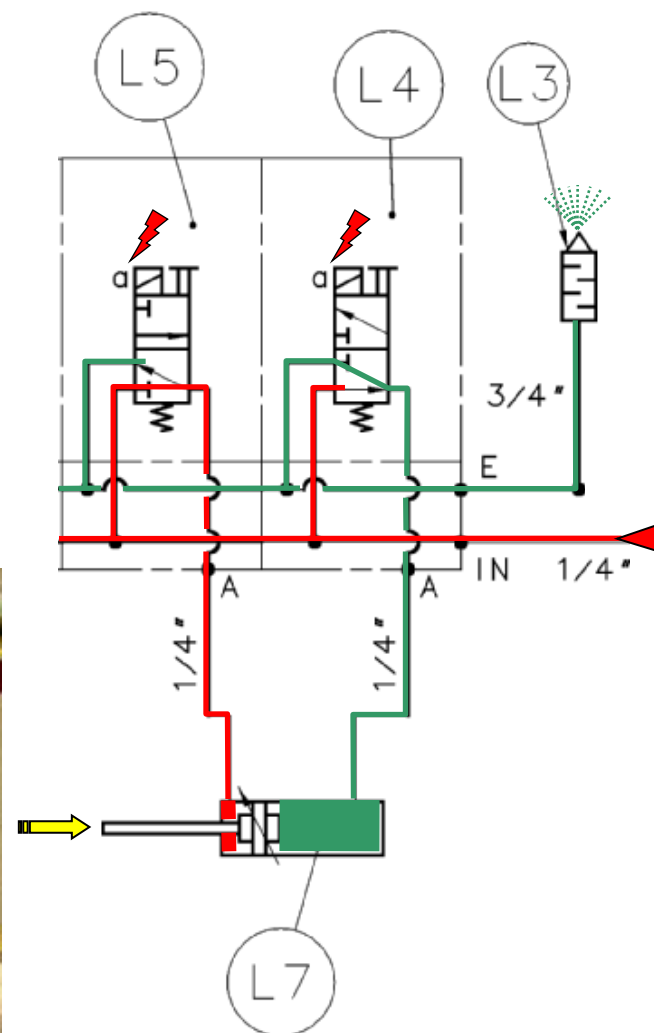
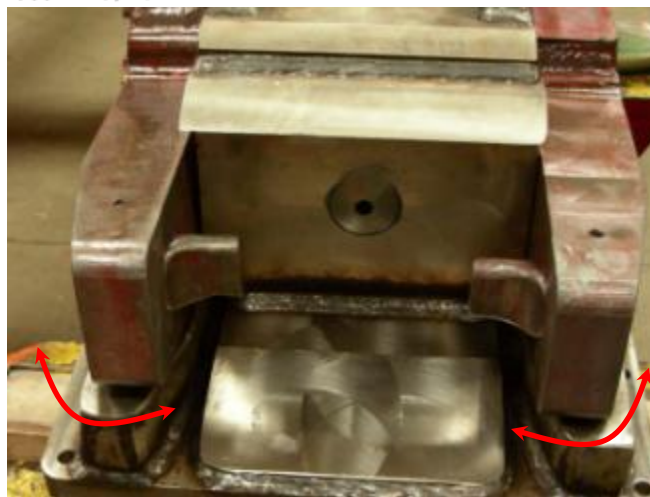
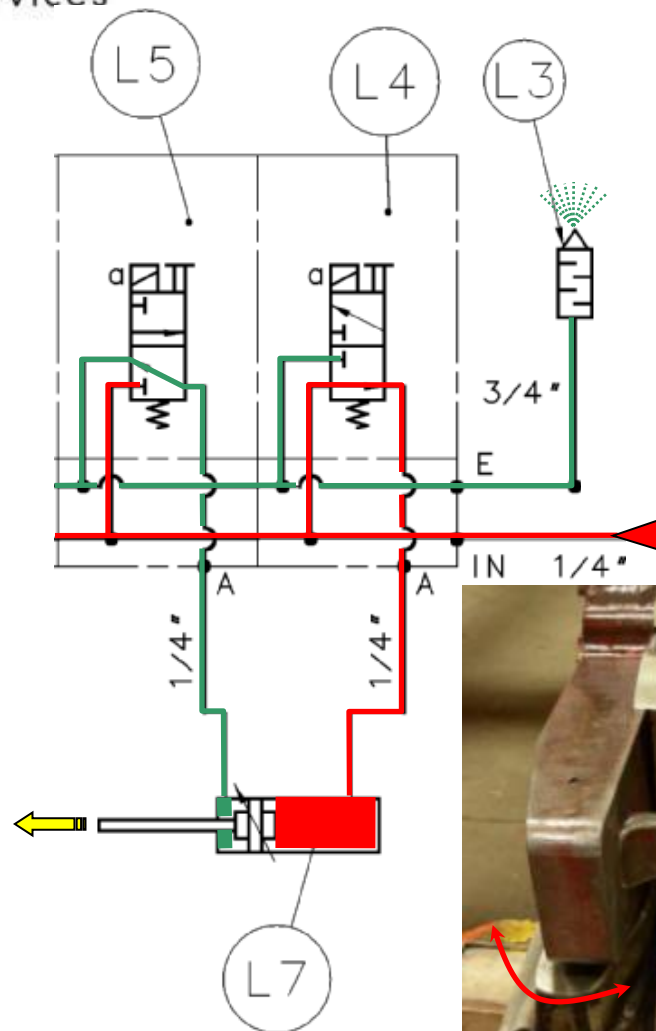


Tightening device unlocking

Tightening device
Normally Lock

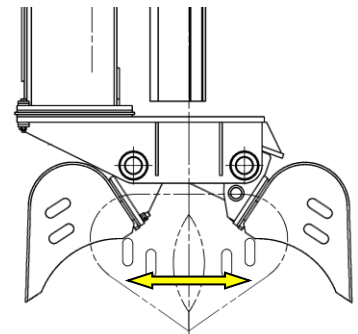
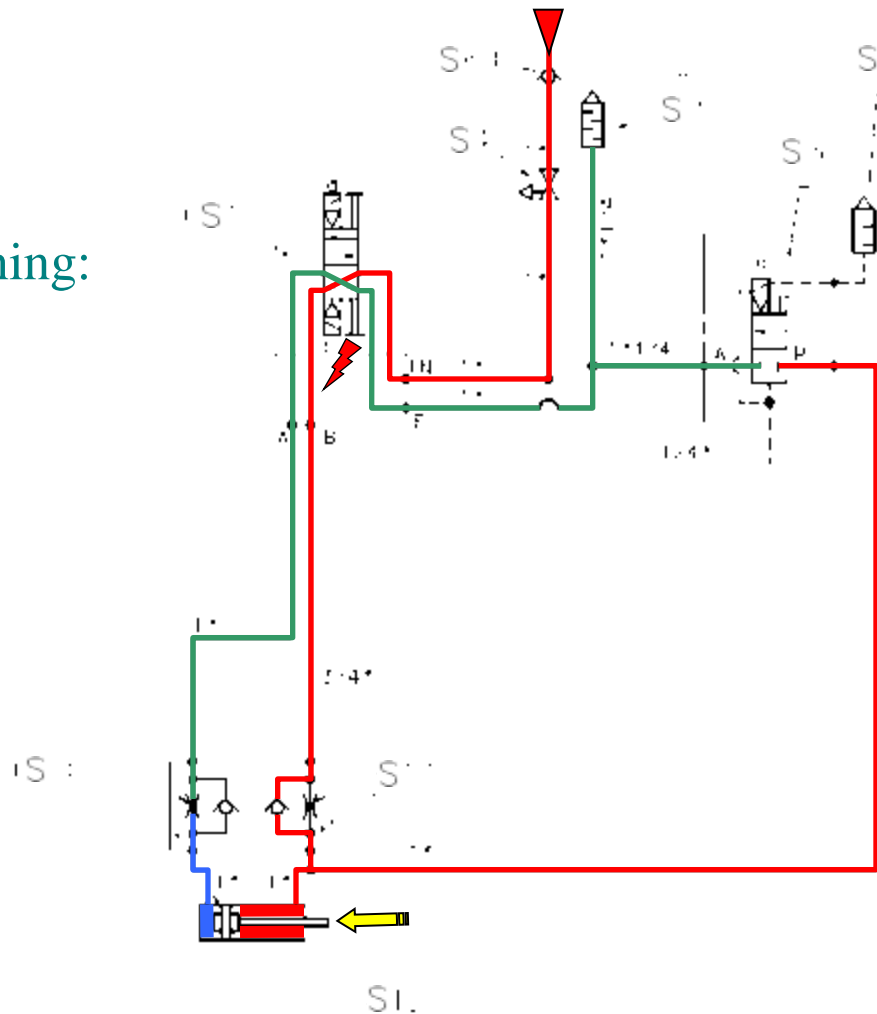


Clamp extracting



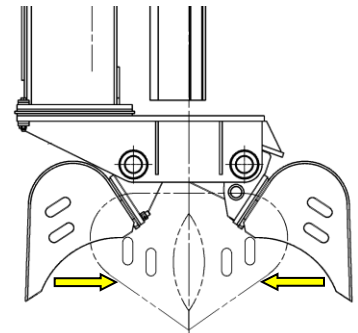
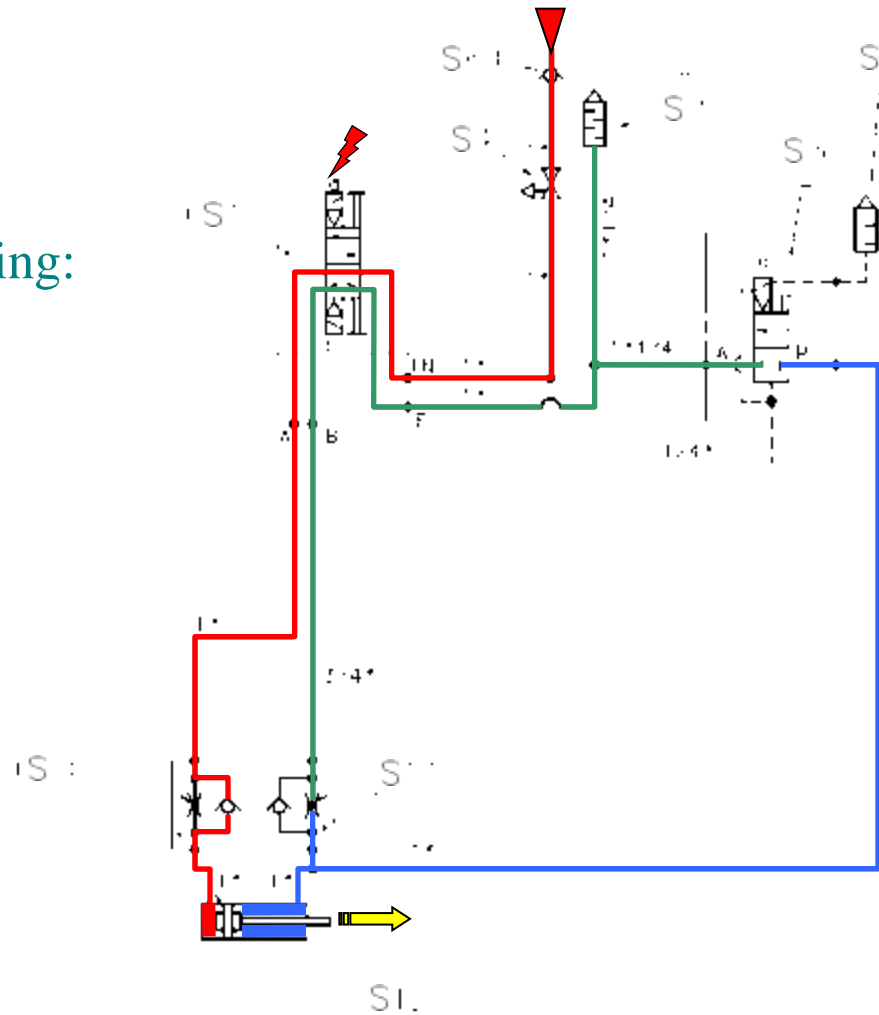
Shovel closing

Bucket opening:
W1b on



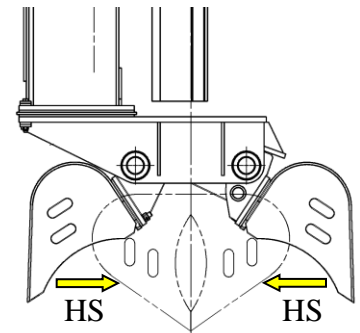
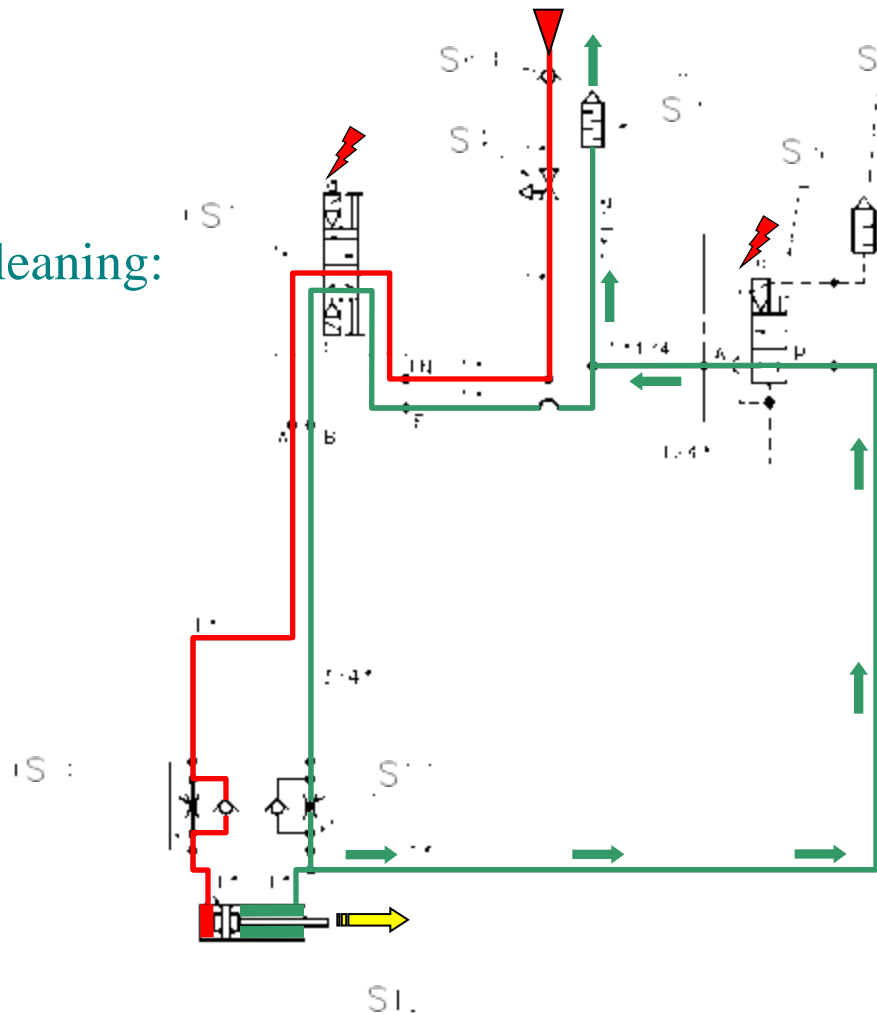
Shovel closing

Bucket closing: W1a on



Shovel closing

Bucket closing & cleaning:
W1a & W3a on





<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

**THANK YOU FOR YOUR
ATTENTION**

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MA'ADEN PROJECT

P1034 - PTM

POT TENDING MACHINE

Hydraulic adjustment

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

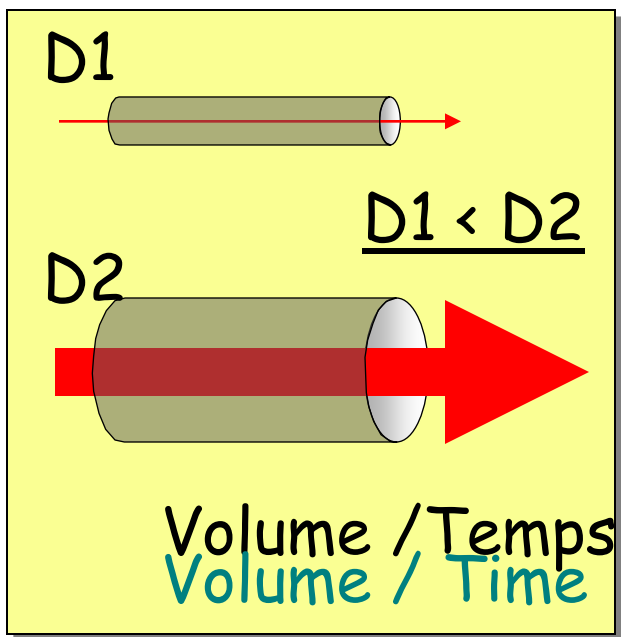
NOTIONS

NOTIONS

DEBIT \neq PRESSION

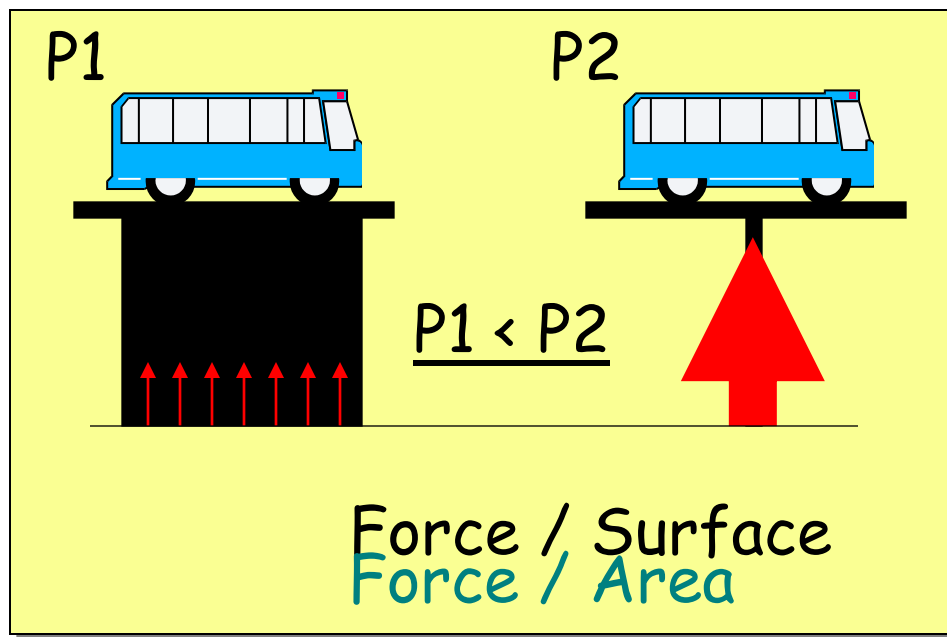
FLOW \neq PRESSURE

● Débit Flow



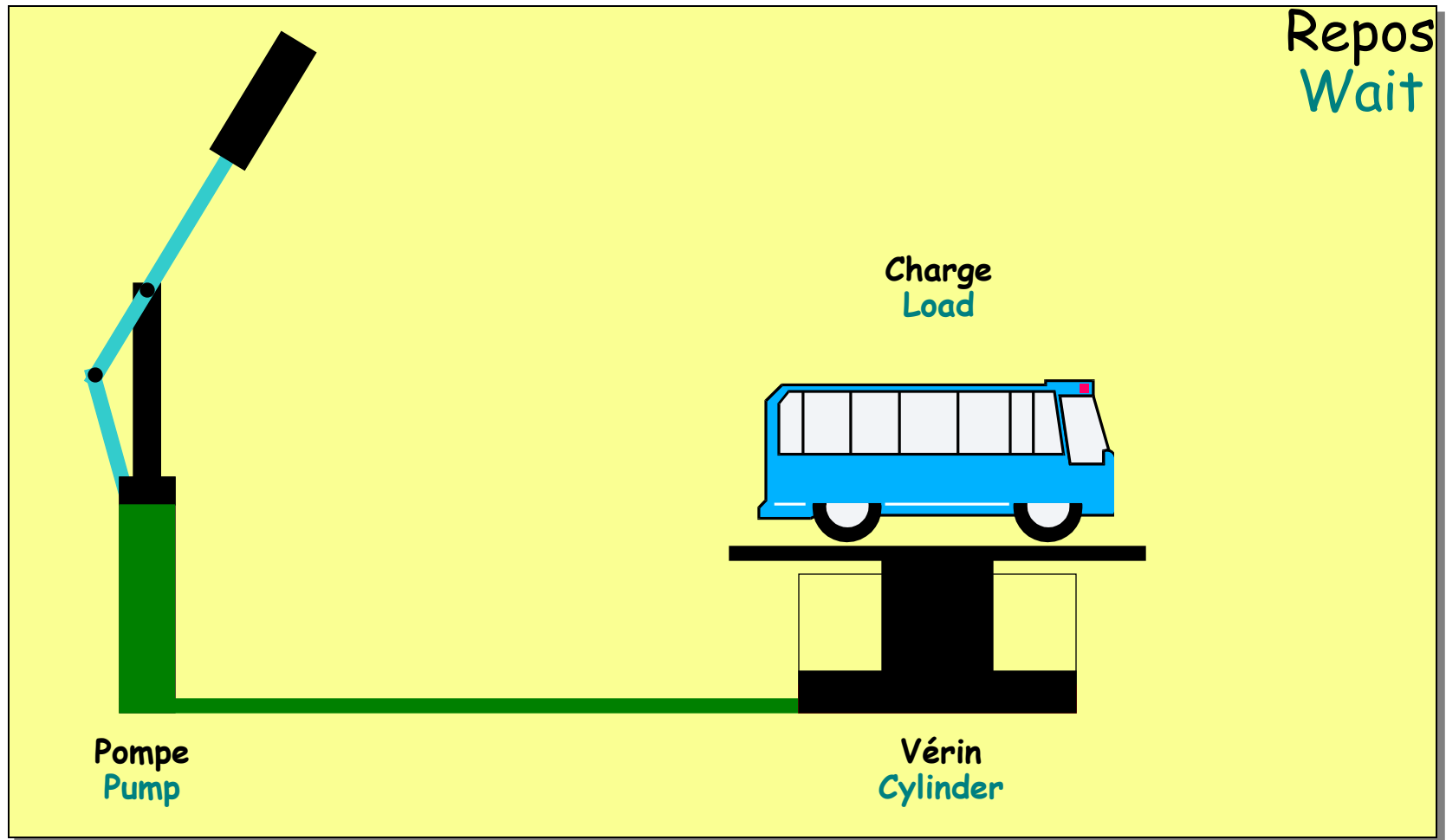
Débit \rightarrow vitesse
Flow \rightarrow speed

● Pression Pressure



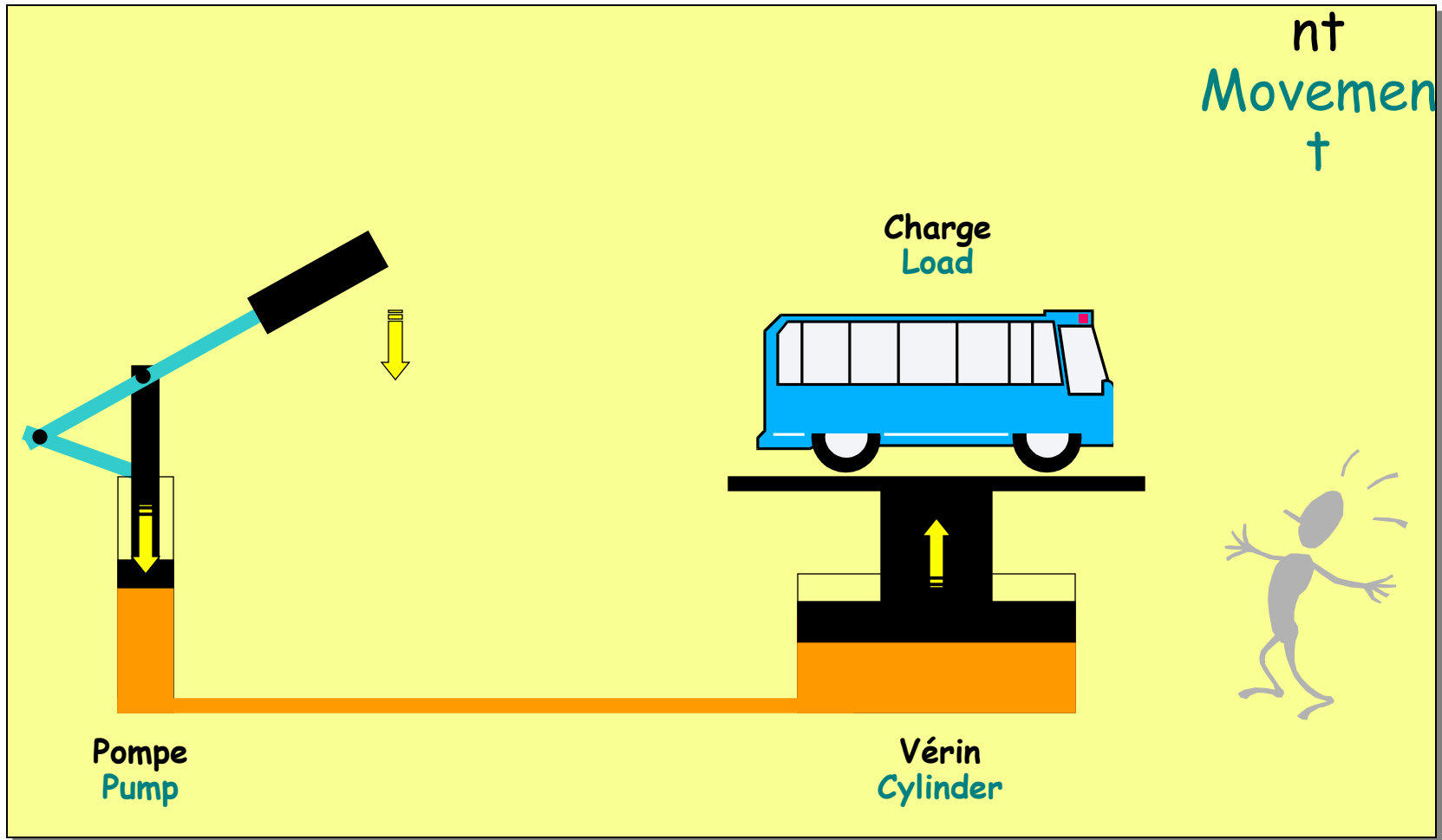
Pression \rightarrow force
Pressure \rightarrow force

NOTIONS NOTIONS



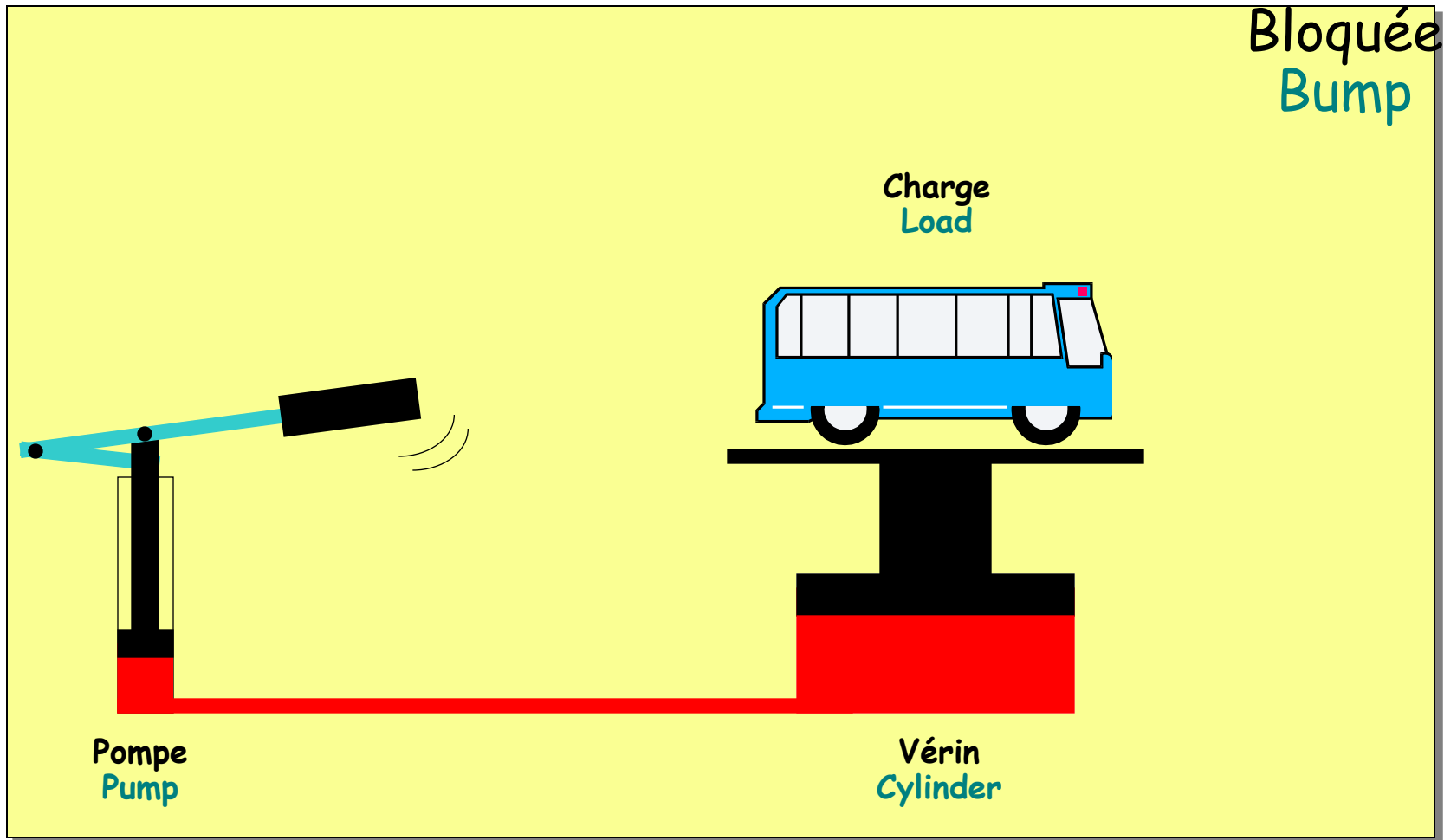
NOTIONS NOTIONS

Mouvement
Mouvement
†



NOTIONS NOTIONS

Bloquée
Bump



NOTIONS NOTIONS

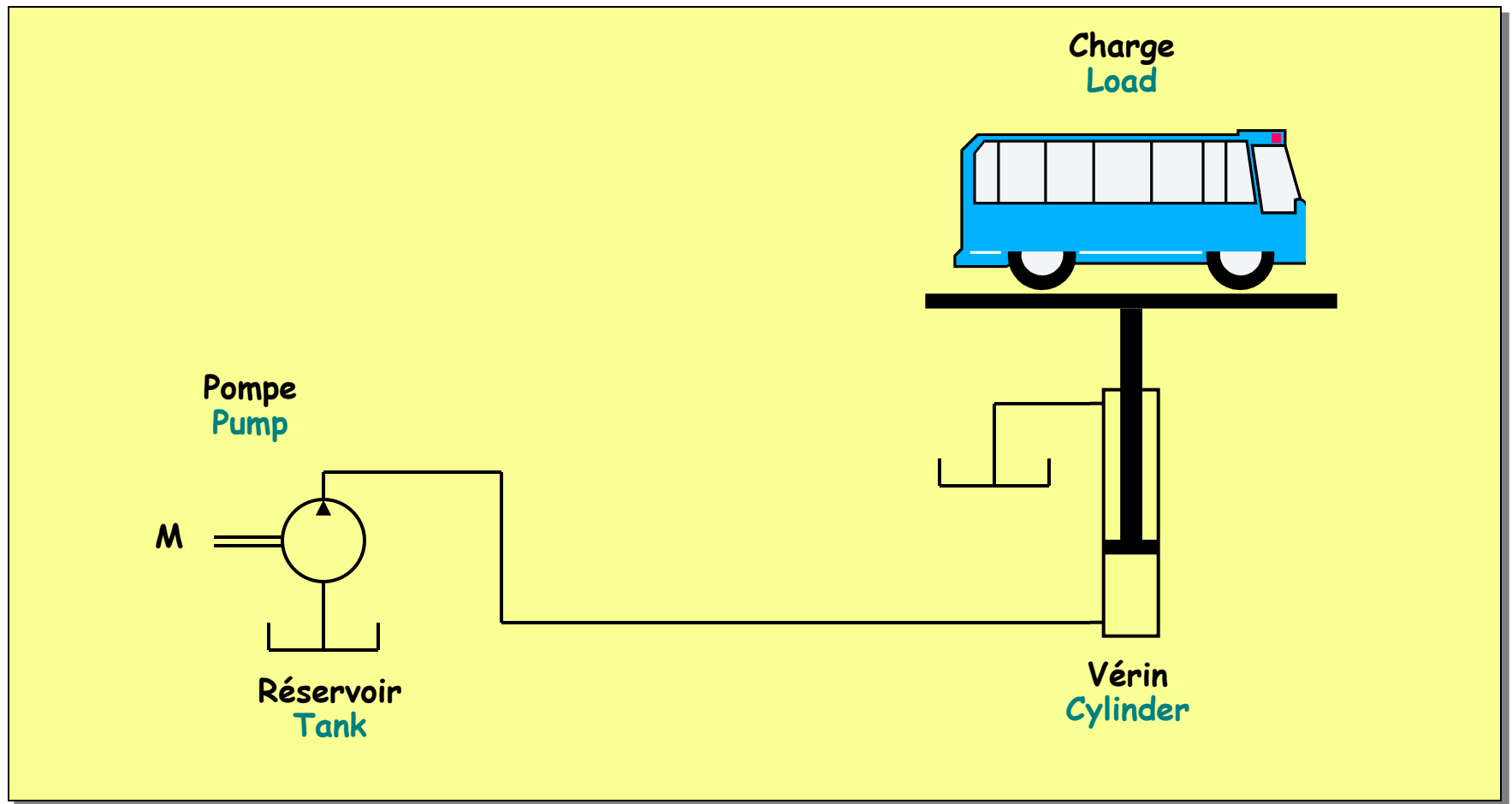


Figure 1.

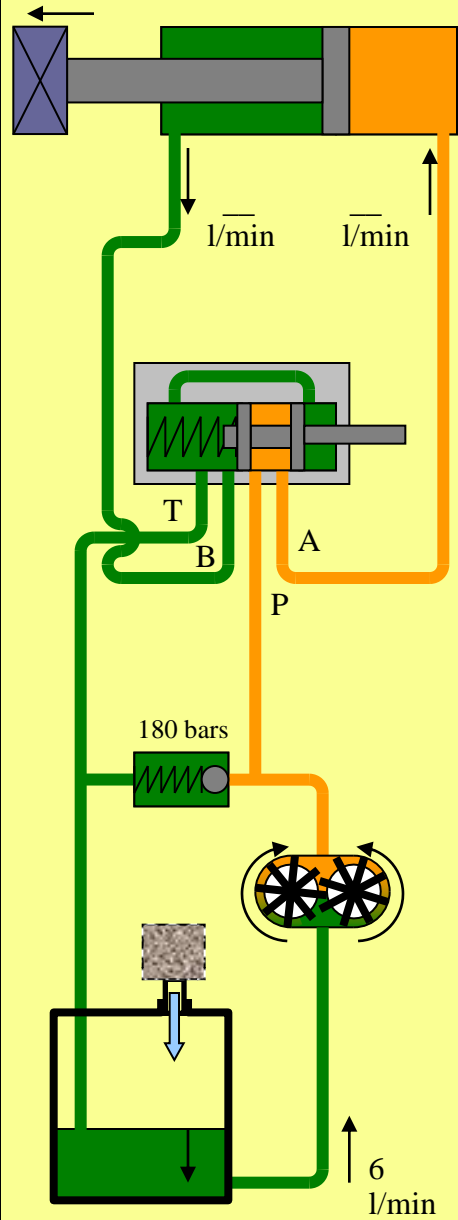


Figure 2.

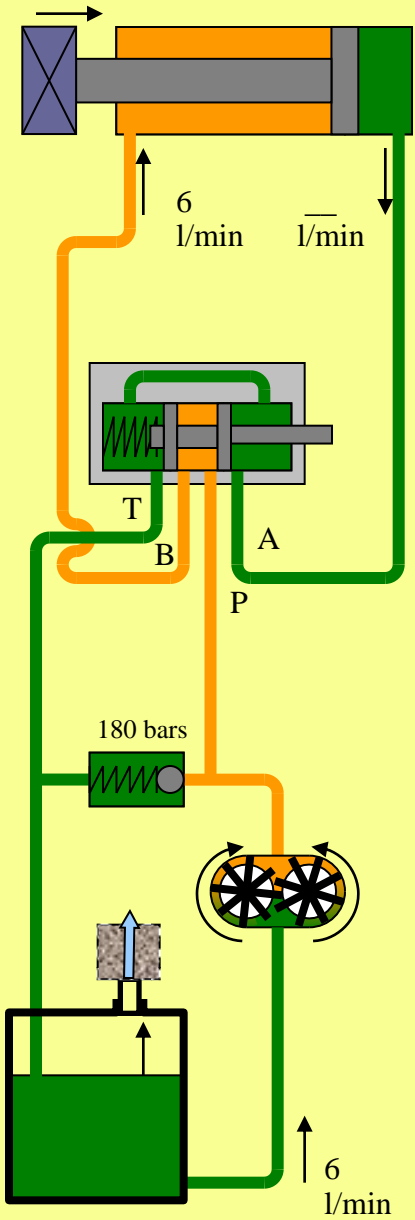


Figure 3.

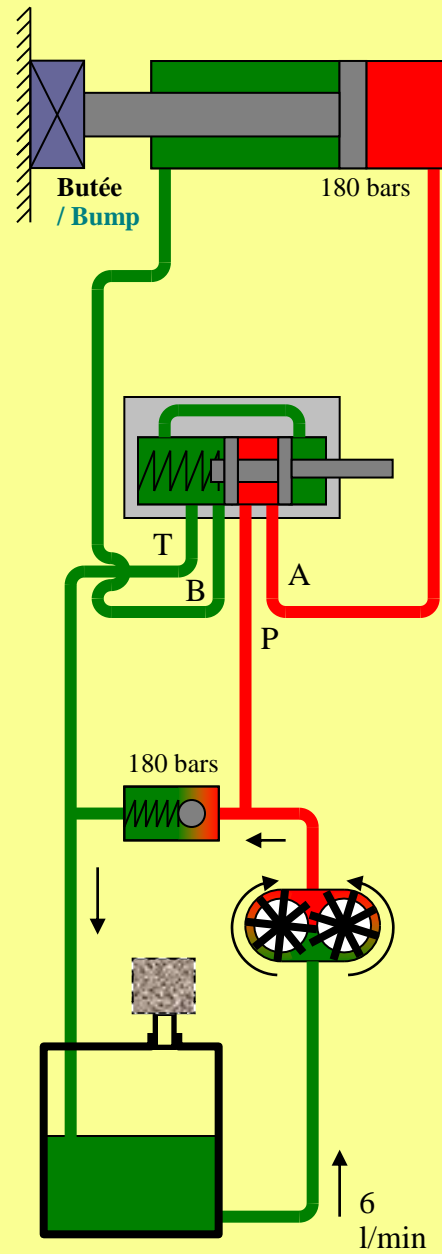


Figure 4.

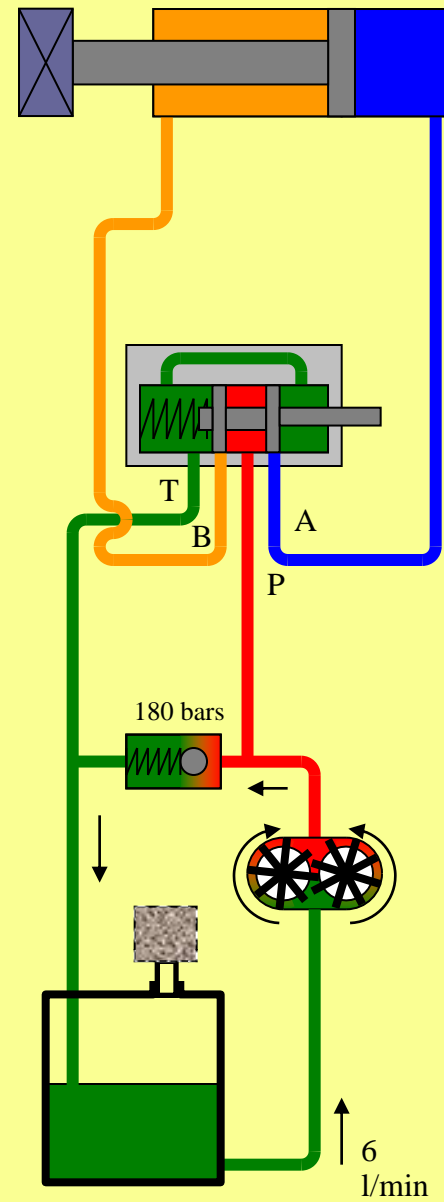


Figure 5.

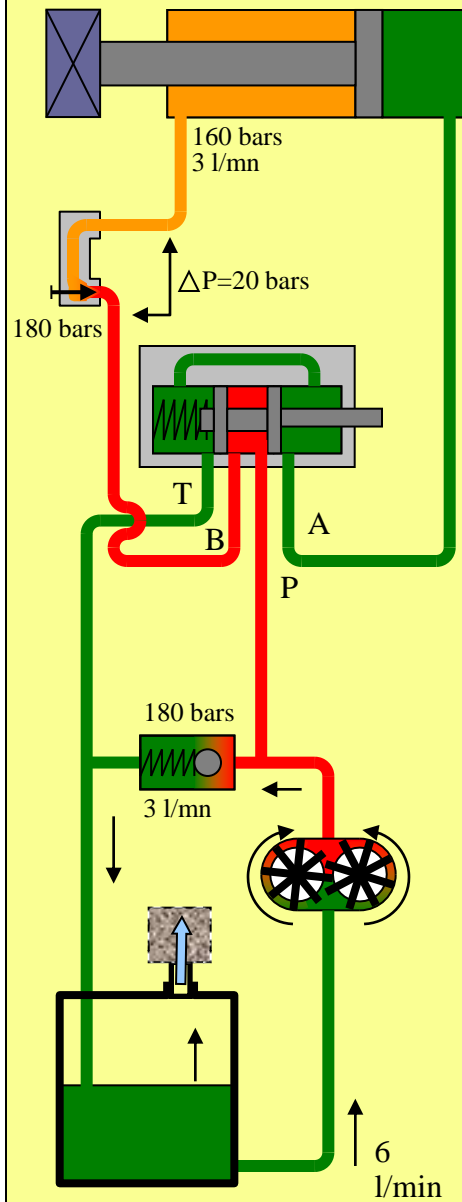
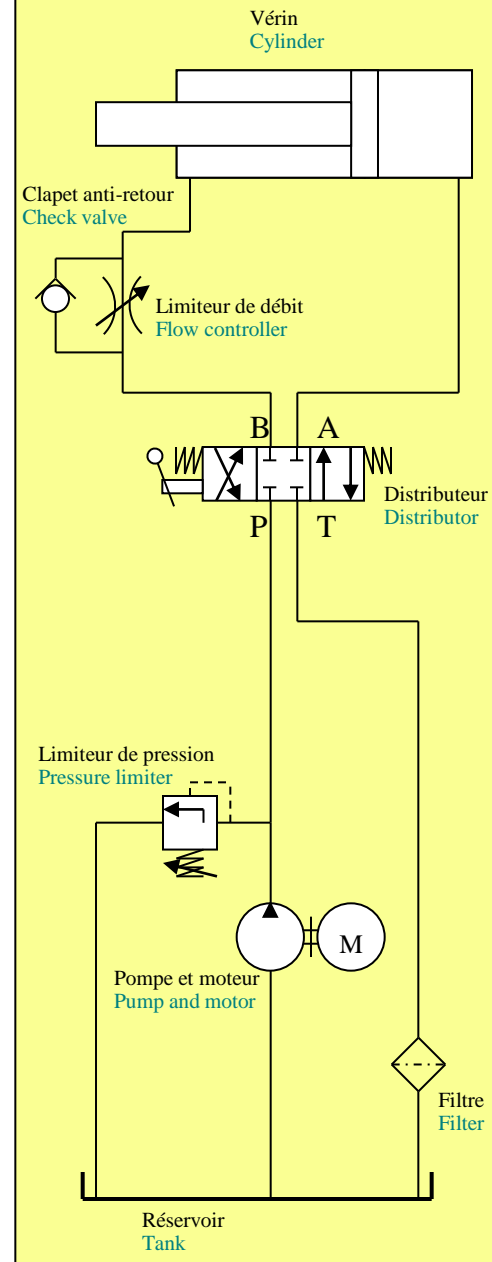
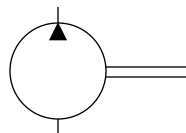


Figure 6.

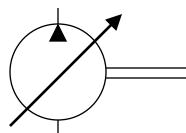


SYMBOLES SYMBOLS

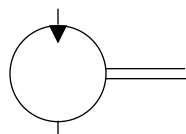


Pompe
hydraulique

Pump



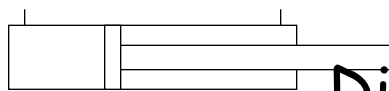
Pompe hydraulique à
cylindrée réglable Variable
displacement pump



Moteur

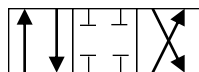
hydraulique

Hydraulic motor



Vérin

Cylinder



Distributeur

Directional



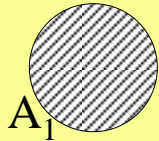
Reservoir
Tank



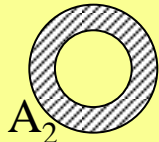
Filtre
Filter

SECTION DOUBLE DE VERIN DOUBLE SECTION CYLINDER

Vérin 80/56 mm
Cylinder 80/56 mm

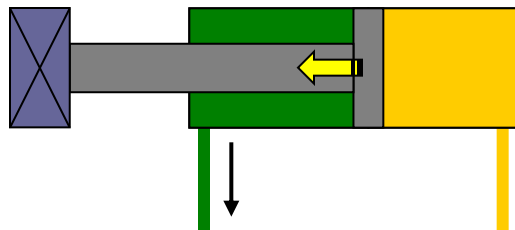
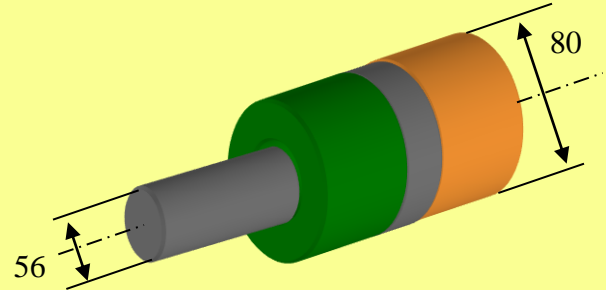


$$A_1 = 3.14 \times r_1^2 = 3.14 \times 40^2 = 5026 \text{ mm}^2$$



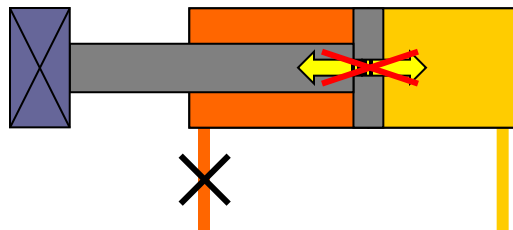
$$A_2 = A_1 - 3.14 \times r_2^2 = 5026 - 3.14 \times 28^2 = 2463 \text{ mm}^2$$

x 2



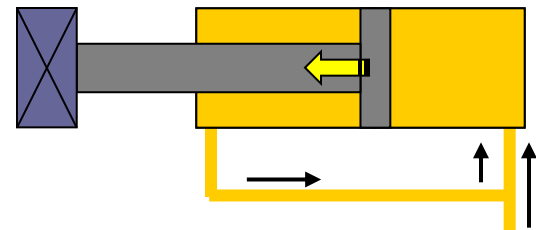
D= 3 l/m
P= 0 bars
F= 0 N <
S= 25 cm²

2D= 6 l/m
P=50 bars
F= 2500 N
2S= 50 cm²



D= 0 l/m
P= 100 bars
F= 2500 N =
S= 25 cm²

D= 0 l/m
P= 50 bars
F= 2500 N
2S= 50 cm²



D= 3 l/m
P= 50 bars
F= 1250 N <
S= 25 cm²

2D= 6 l/m
P=50 bars
F= 2500 N
2S= 50 cm²

D: Débit / Flow

P: Pression / Pressure

F: Force / Force

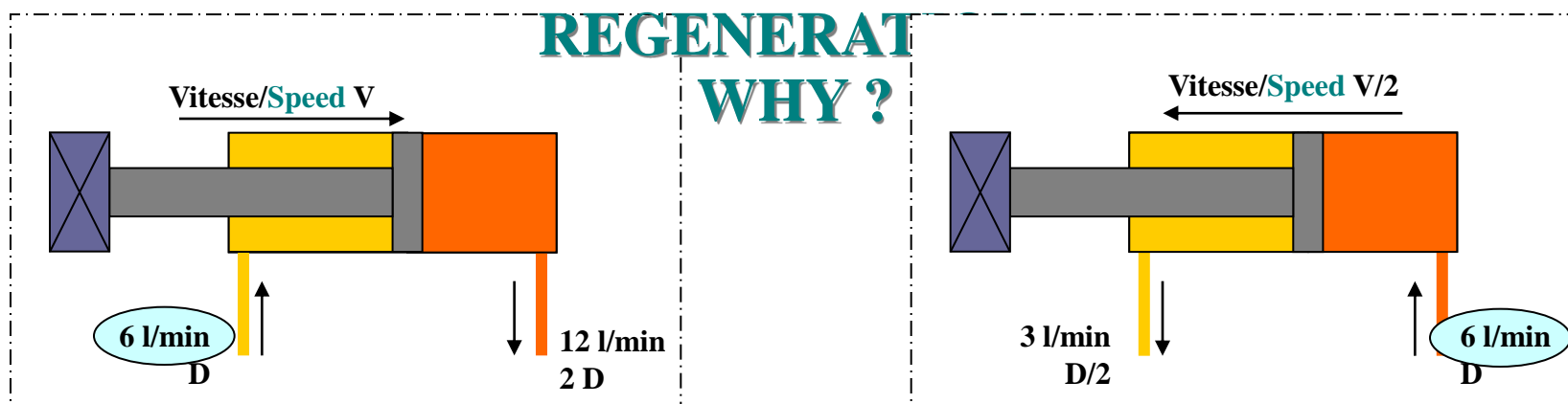
S: Surface / Area

RE-ALIMENTATION REGENERATION

POURQUOI RE- ALIMENTER ?

Débit $D = 6 \text{ l/min}$
Flow $D = 6 \text{ l/min}$

REGENERATION WHY ?



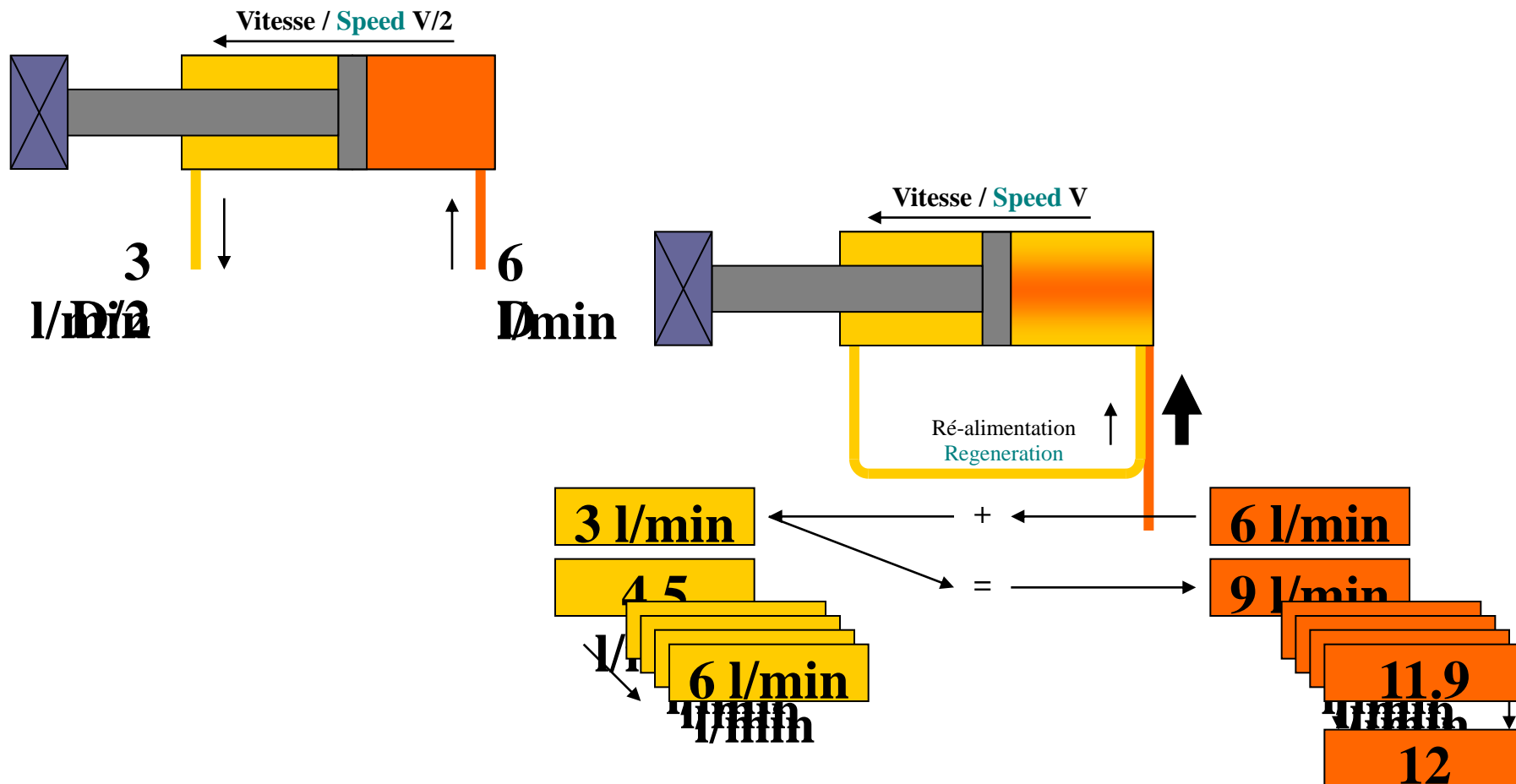
Lorsque l'on utilise des vérins avec un débit donné D , la vitesse de tige n'est pas le même suivant que l'on alimente le vérin coté tige ou coté fond. Le rapport de vitesse dépend du rapport de section du vérin.
Lorsque le rapport de section est de 2, la vitesse de tige est divisée par 2 lorsque l'on alimente le vérin coté fond.
La ré-alimentation consiste à ré-injecter l'huile sortant du coté tige dans le coté fond.

When we use a cylinder with a constant flow D . The speed of the cylinder rod is not the same when we supply oil from the rod side or from the head side. The speed ratio depend of the section ratio of the cylinder.

When the section ratio is 2, the speed of the rod is divided by 2 when we supply oil from the head side.

The regeneration consists in re-inject oil from the rod side to the head side.

RE-ALIMENTATION REGENERATION



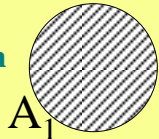
$$6 + 3 + 1.5 + 0.75 + 0.375 + 0.187 + 0.0937 + 0.0468 \dots = 12 \text{ l/min}$$

SECTION 1,5 DE VERIN

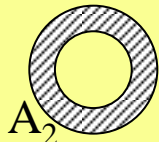
1,5 SECTION CYLINDER

ONLY FOR EXTRACTING DEVICE

Vérin 100/56 mm
Cylinder 100/56 mm

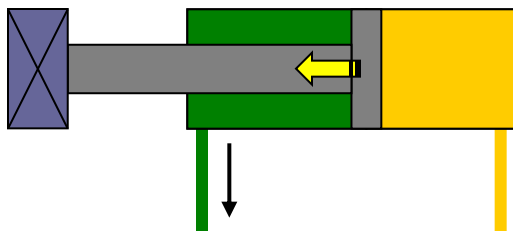
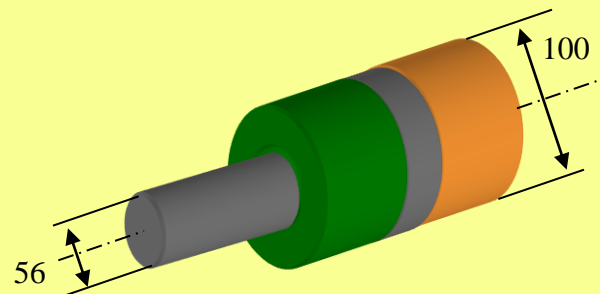


$$A_1 = 3.14 \times r_1^2 = 3.14 \times 50^2 = 7854 \text{ mm}^2$$

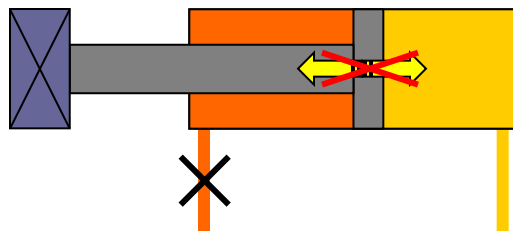


$$A_2 = A_1 - 3.14 \times r_2^2 = 7854 - 3.14 \times 28^2 = 5390 \text{ mm}^2$$

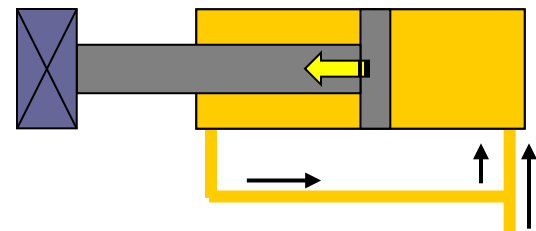
x 1,5



D= 4 l/min
P= 0 bar
F= 0 N <
S= 54 cm²



D= 0 l/min
P= 75 bar
F=3950daN =
S= 54 cm²



D= 4 l/min
P= 50 bar
F= 2700 N <
S= 54 cm²

1,5D= 6 l/min
P=50 bar
F=3950daN
1,5S= 79 cm²

D: Débit / Flow

P: Pression / Pressure

F: Force / Force

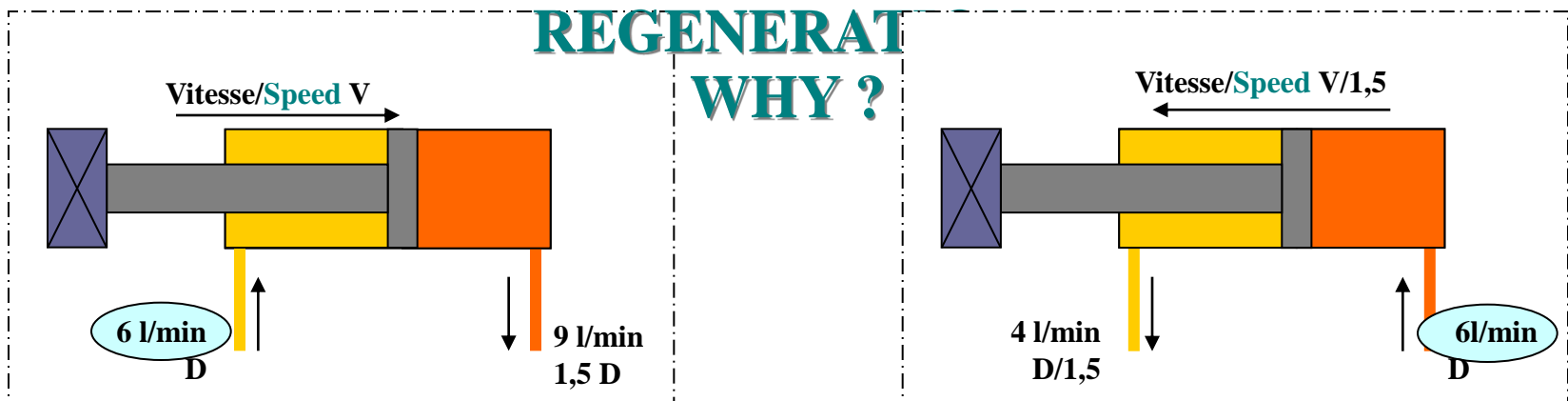
S: Surface / Area

RE-ALIMENTATION REGENERATION

POURQUOI RE- ALIMENTER ?

Débit $D = 6 \text{ l/min}$
Flow $D = 6 \text{ l/min}$

REGENERATION WHY ?



Lorsque l'on utilise des vérins avec un débit donné D , la vitesse de tige n'est pas la même suivant que l'on alimente le vérin coté tige ou coté fond. Le rapport de vitesse dépend du rapport de section du vérin.

Lorsque le rapport de section est de 1,5, la vitesse de tige est divisée par 1,5 lorsque l'on alimente le vérin coté fond.

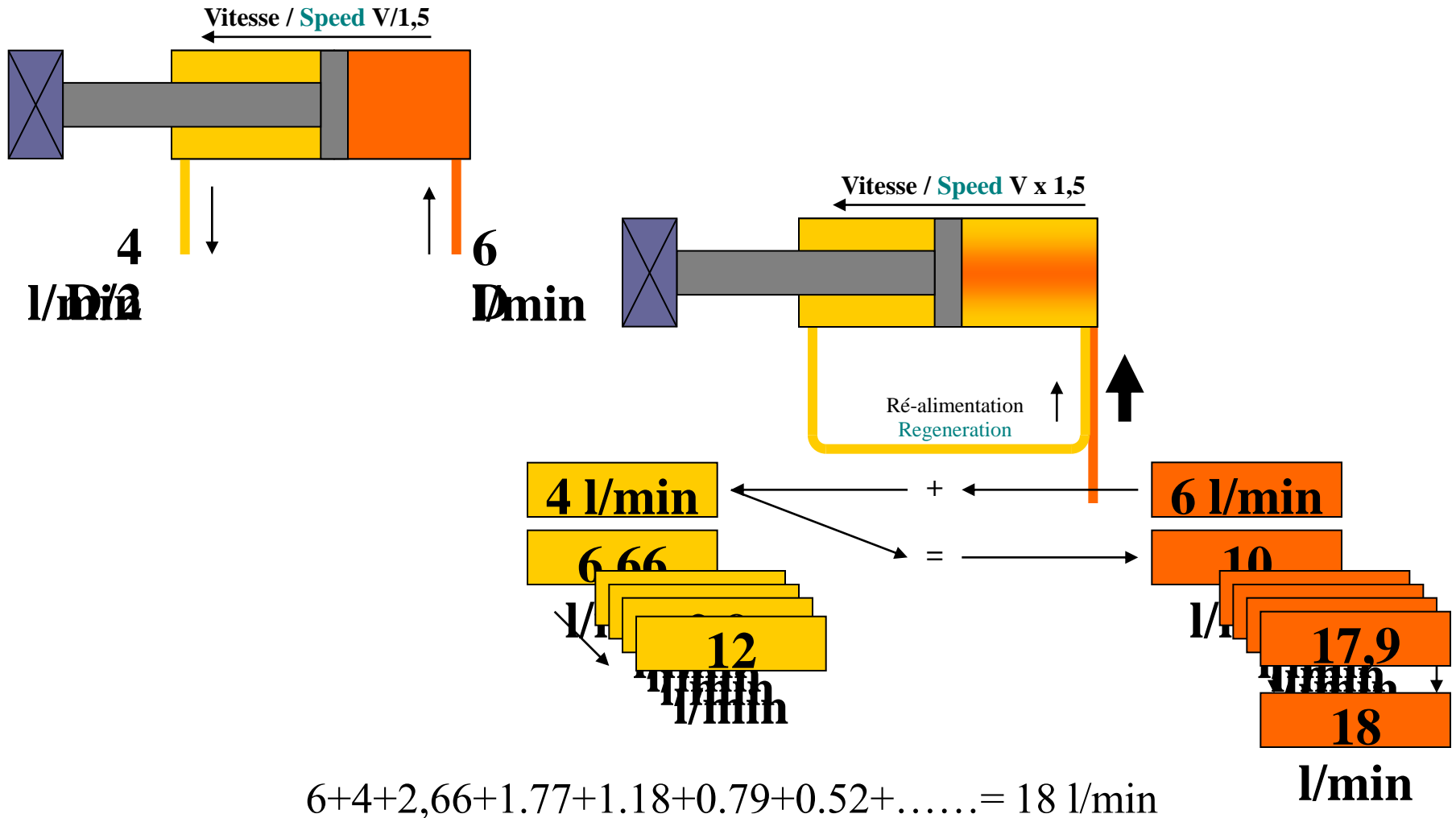
La ré-alimentation consiste à ré-injecter l'huile sortant du coté tige dans le coté fond.

When we use a cylinder with a constant flow D . The speed of the cylinder rod is not the same when we supply oil from the rod side or from the head side. The speed ratio depend of the section ratio of the cylinder.

When the section ratio is 1,5, the speed of the rod is divided by 1,5 when we supply oil from the head side.

The regeneration consists in re-inject oil from the rod side to the head side.

RE-ALIMENTATION REGENERATION

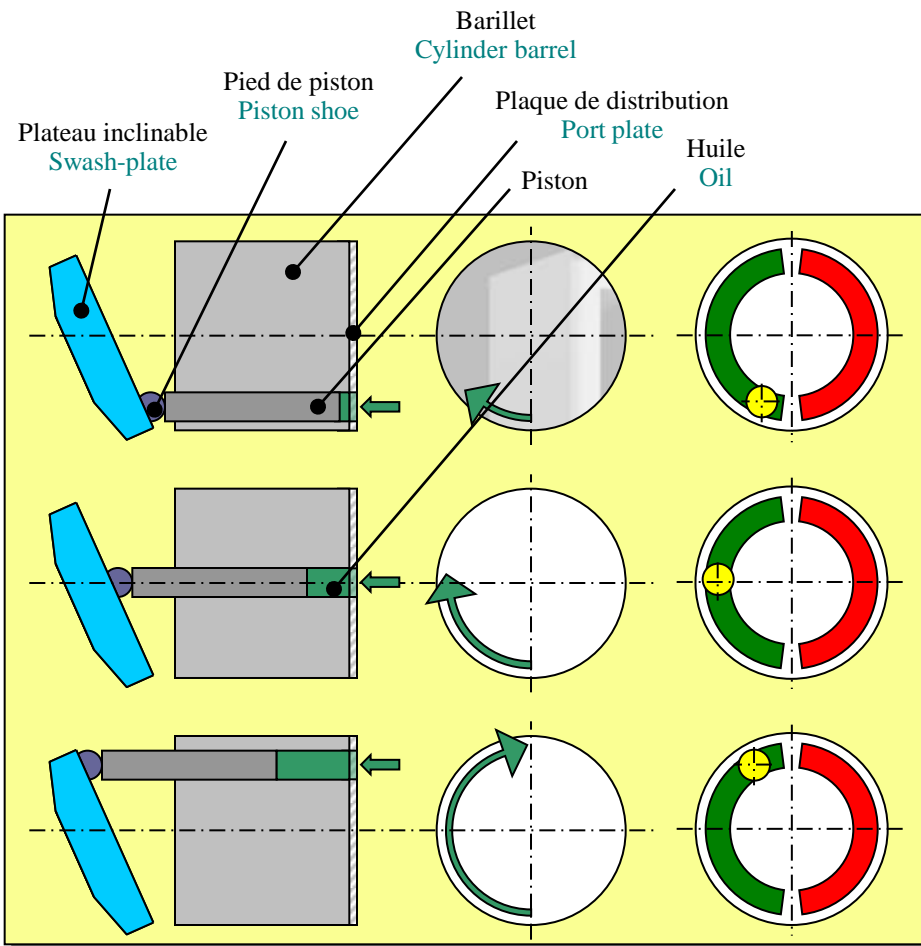


EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

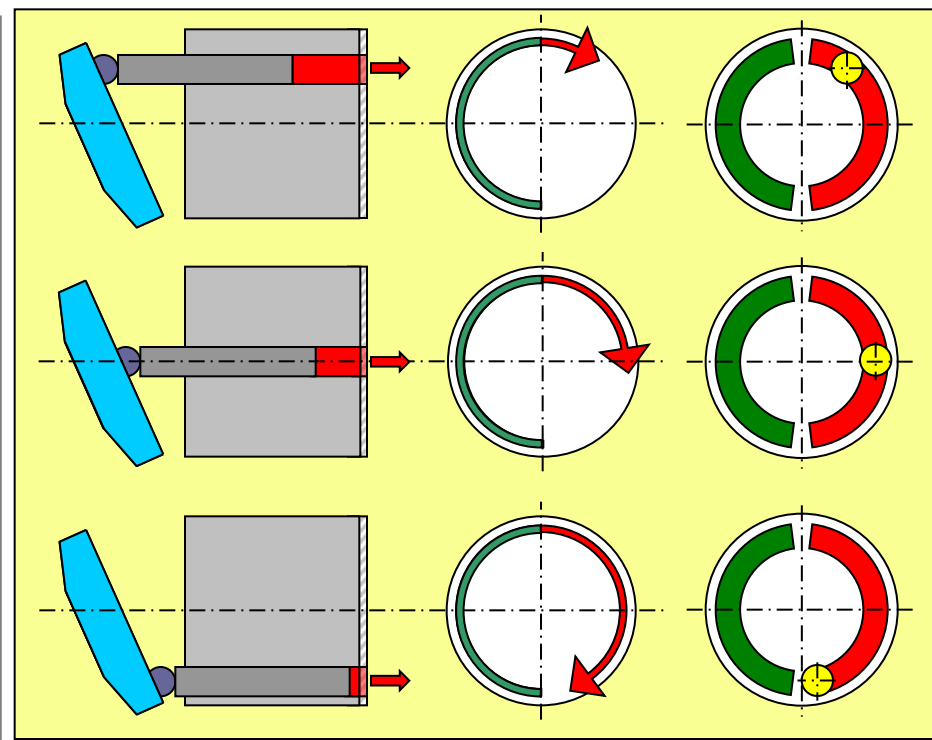
POMPES **PUMPS**

POMPES A PISTONS AXIAUX

AXIAL PISTON PUMP

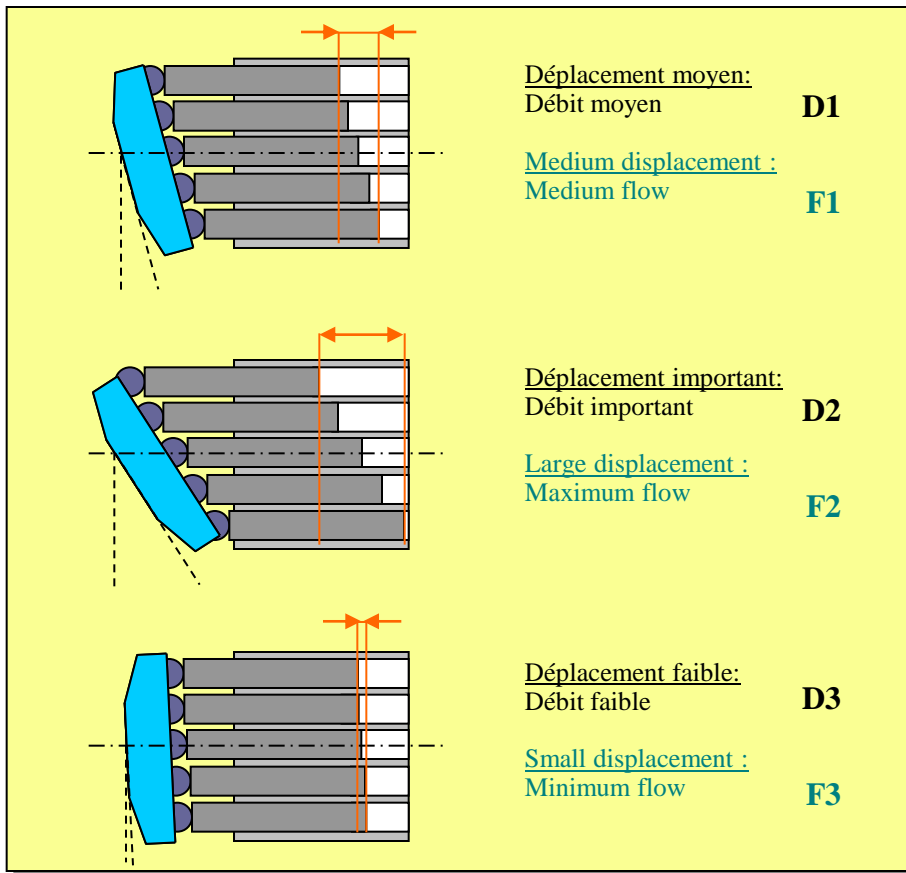


ASPIRATION / SUCTION



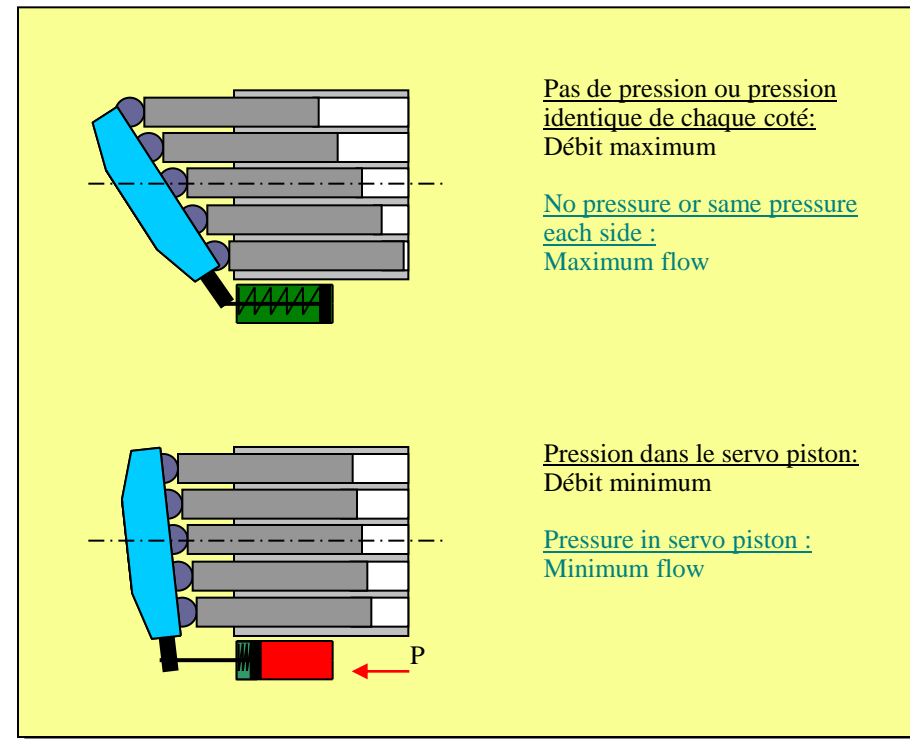
REFOULEMENT / OUTLET

DEBIT VARIABLE VARIABLE FLOW



REFOULEMENT/OUTLET

$D3 < D1 < D2$
 $F3 < F1 < F2$

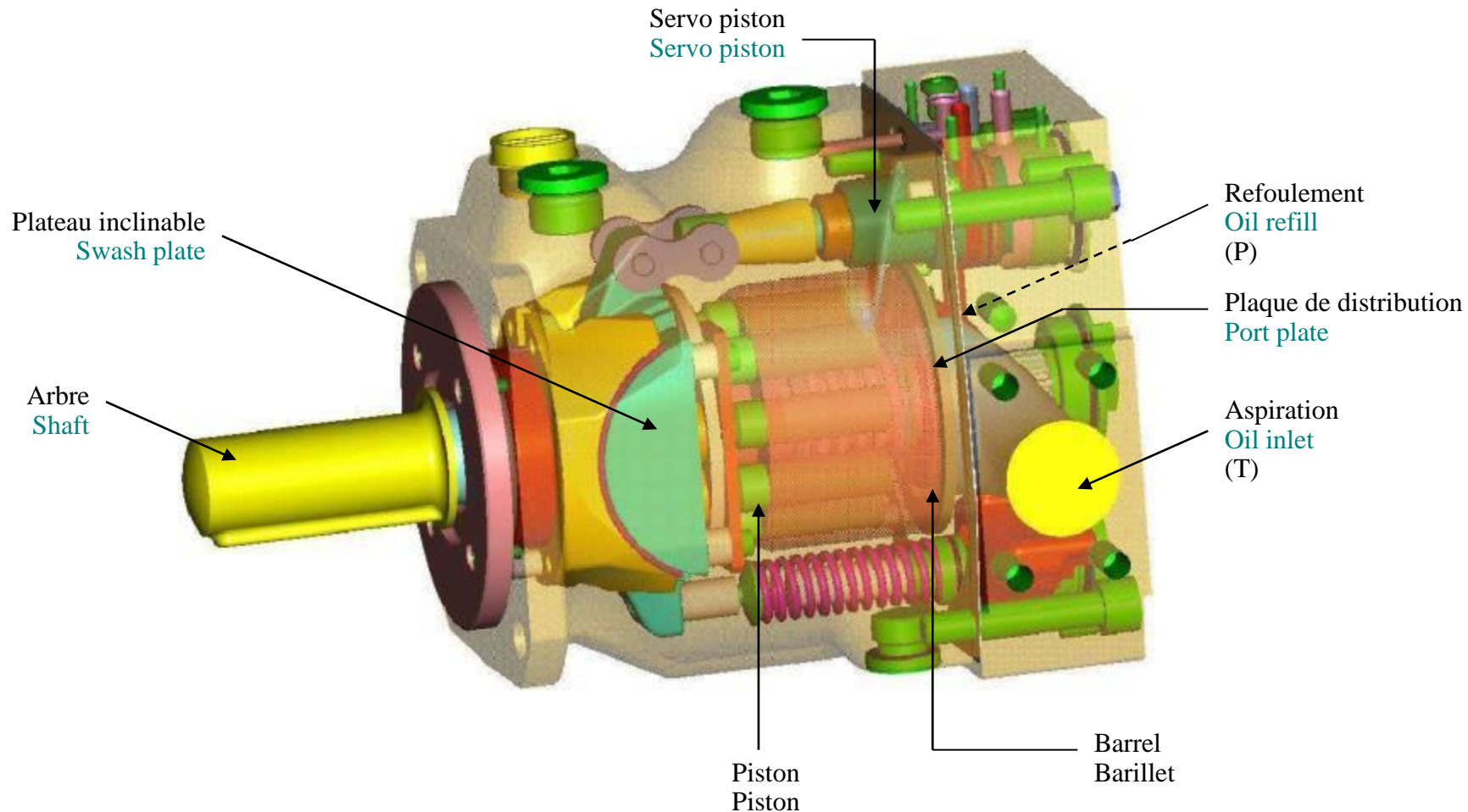


SERVO PISTON

$P7 \rightarrow D2$
 $P7 \rightarrow F2$

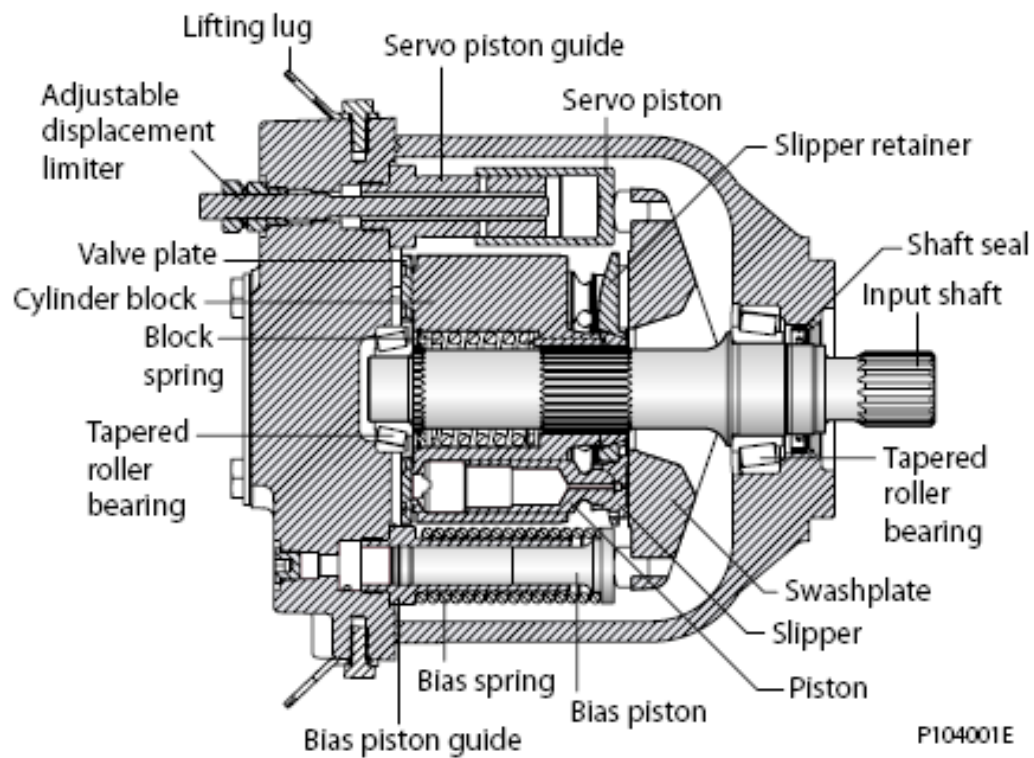
POMPE A DEBIT VARIABLE

VARIABLE FLOW PUMP



POMPE A DEBIT VARIABLE

VARIABLE FLOW PUMP



EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

DEBIT VARIABLE VARIABLE FLOW

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

VUES SIMPLIFIEES SIMPLIFIED SKETCHES

I. Avec servo piston With servo piston

- ▣ Arrêt
Stop
- ▣ Marche à vide
Stand by
- ▣ Régulation
Flow regulation
- ▣ Butée
Bump

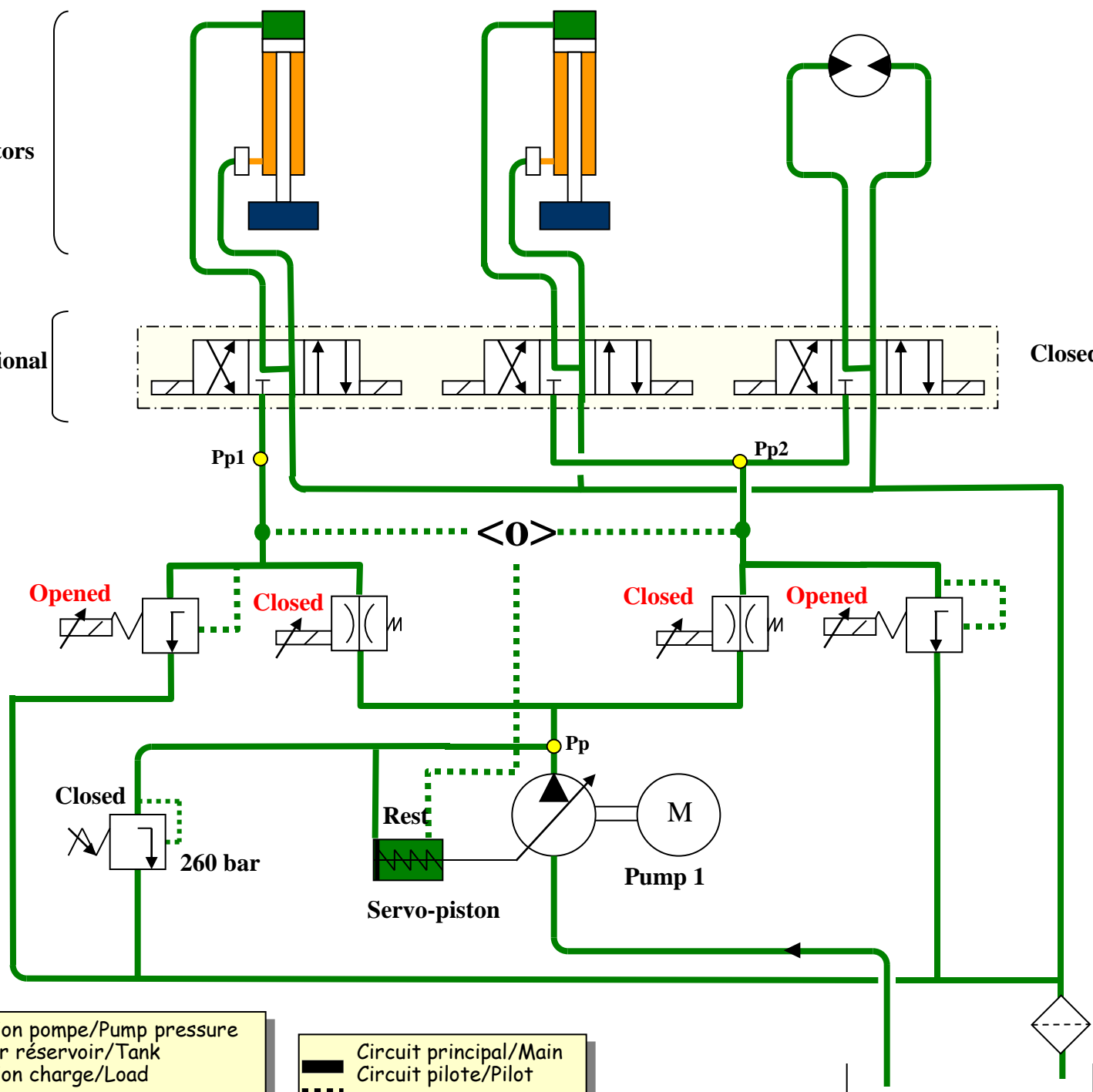
Arrêt
Stop

Actuators

Directional
valves

Closed

Hydraulic
Unit



Pression pompe/Pump pressure
Retour réservoir/Tank
Pression charge/Load

Circuit principal/Main
Circuit pilote/Pilot

Marche à vide
Stand by

Actuators

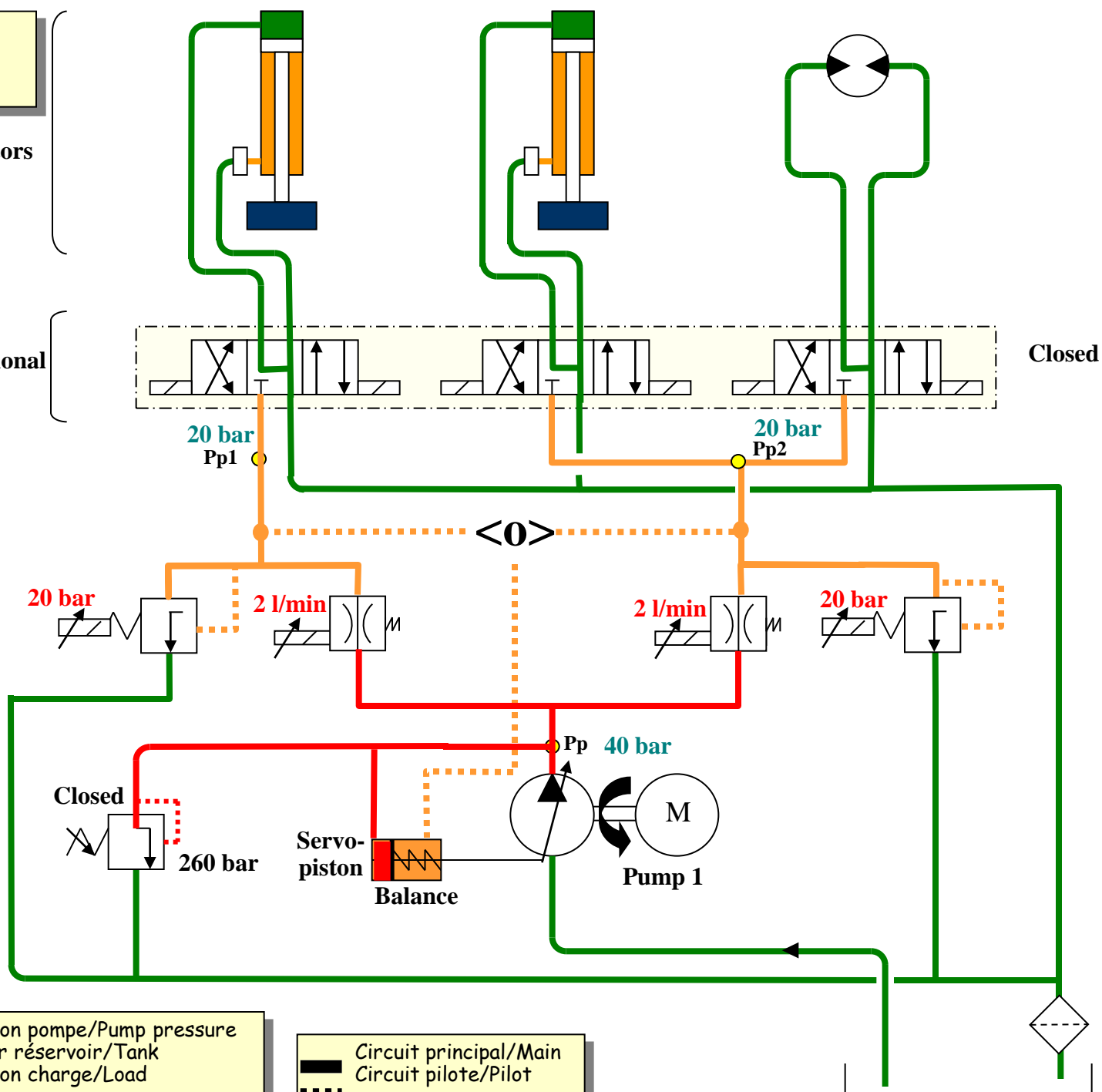
Directional
valves

Closed

Hydraulic
Unit

■ Pression pompe/Pump pressure
■ Retour réservoir/Tank
■ Pression charge/Load

■ Circuit principal/Main
... Circuit pilote/Pilot



Régulation de débit Flow regulation

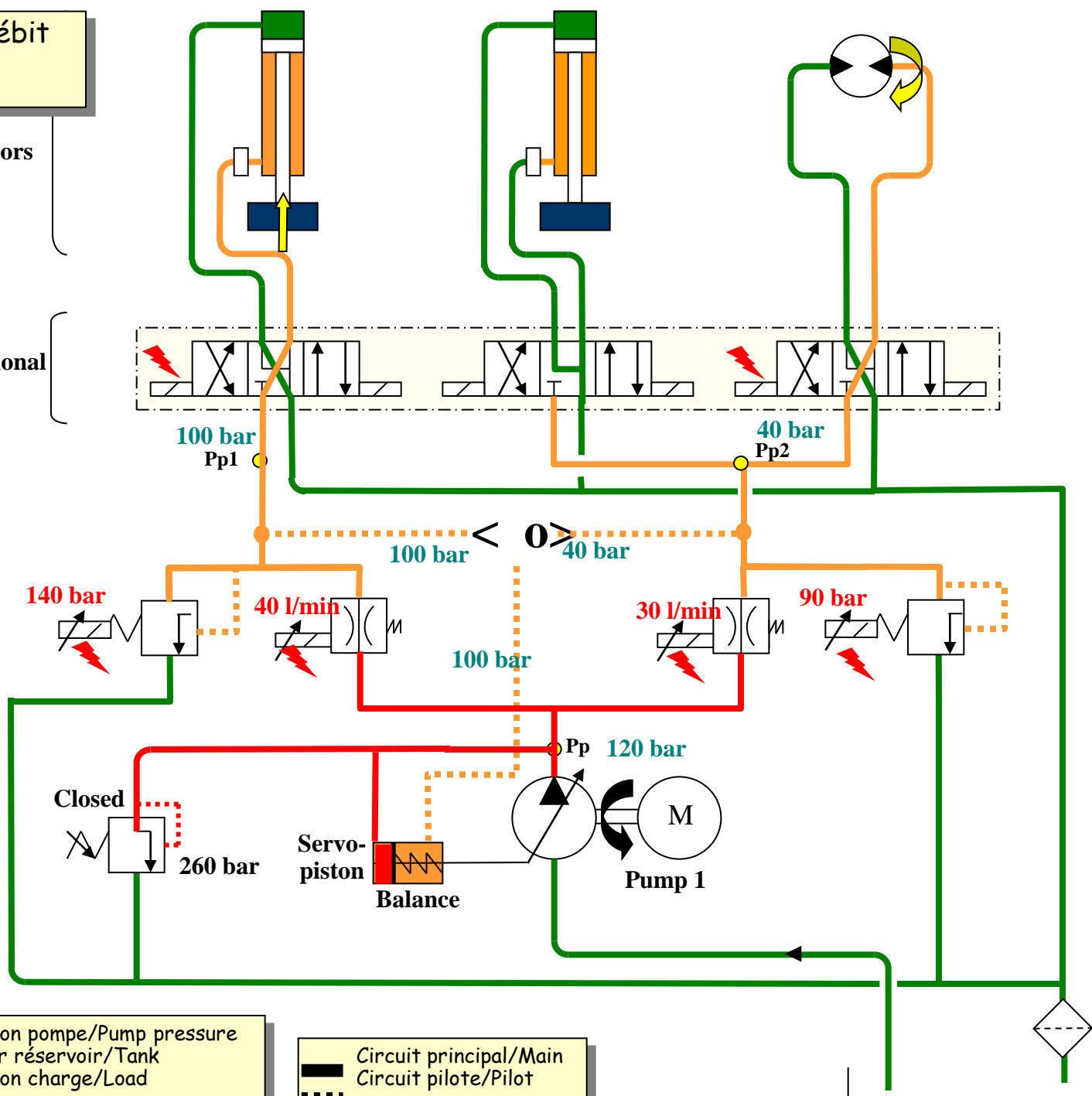
Actuators

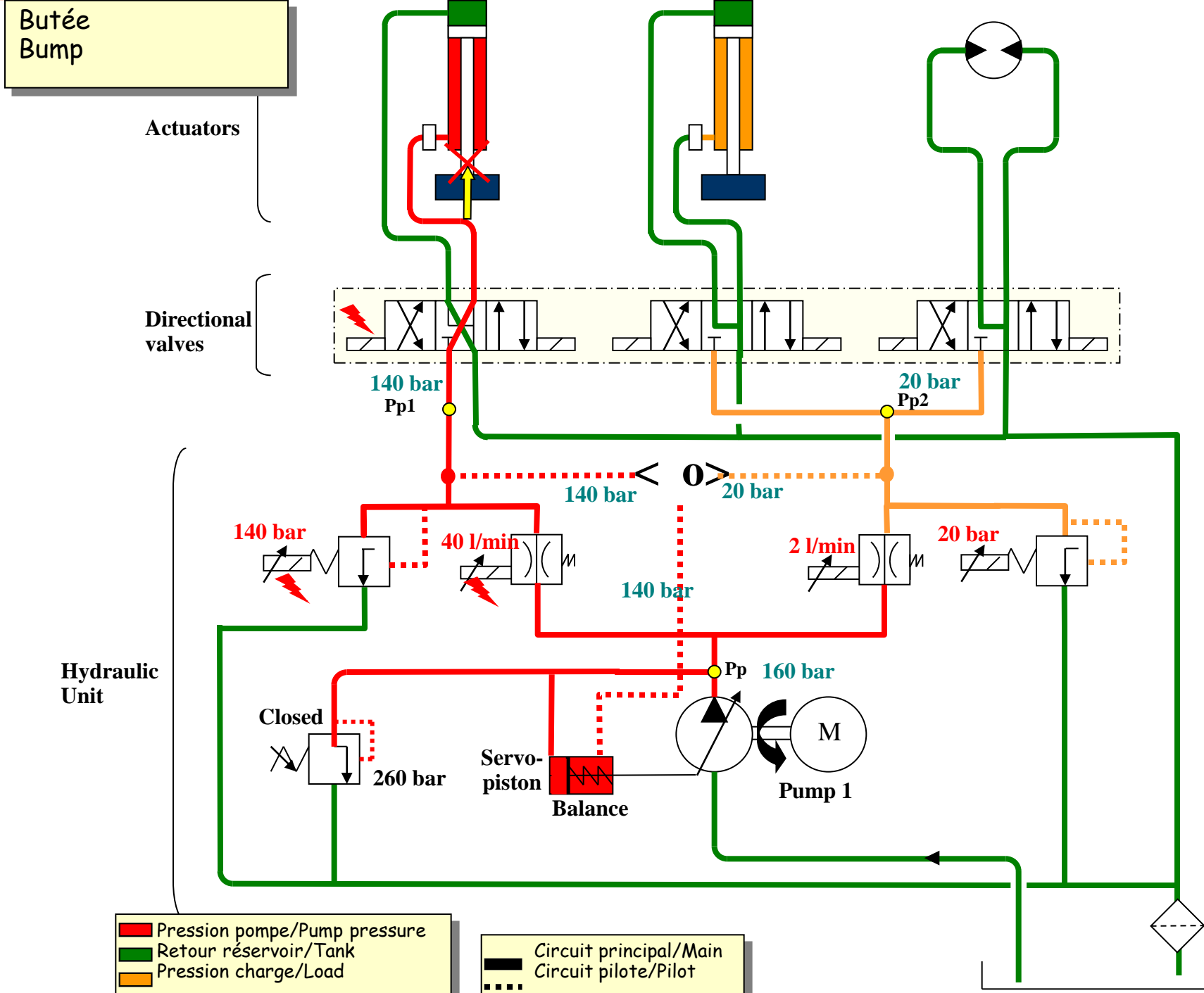
Directional valves

Hydraulic Unit

— Pression pompe/Pump pressure
— Retour réservoir/Tank
— Pression charge/Load

Circuit principal/Main
 Circuit pilote/Pilot





Butée
Bump

Actuators

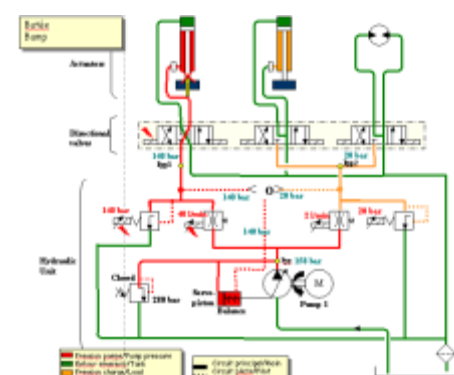
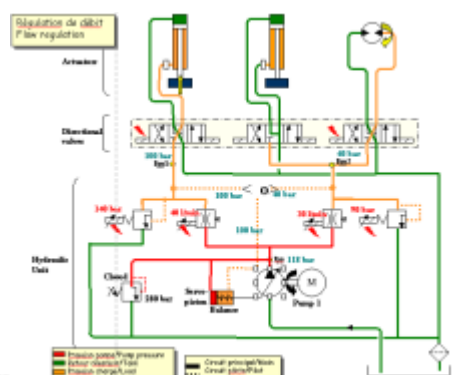
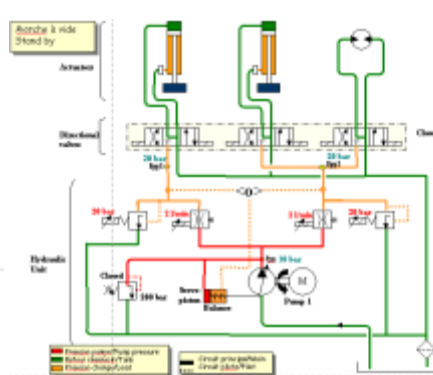
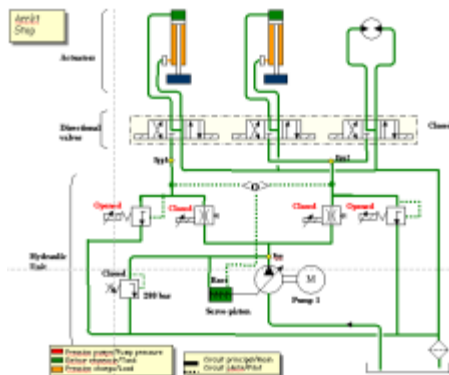
Directional
valves

Hydraulic
Unit

Pression pompe/Pump pressure
Retour réservoir/Tank
Pression charge/Load

Circuit principal/Main
Circuit pilote/Pilot

TABLEAU RECAPITULATIF RECAPITULATIVE BOARD



		Arrêt / Stop	AttenteStand by	Mvt / Movement	Butée / Bump
Excitation / Excitation	Distributeur Directional valve	NF / NC	NF / NC	Ouvert / Open	Ouvert / Open
	Valve % débit % flow valve	NF / NC	NF / NC (2l/min)	Ouvert / Open (consigne / signal)	Ouvert / Open (consigne / signal)
	Limiteur % pression % pressure valve	NO / NO	NO / NO (20 bar)	Fermé / Closed consigne signal	Ouvert / Open by pilot /by pilot
Pompe / Pump	Plateau Swashplate	Maxi	Mini (-)	Moyen / Middle	Moyen / Middle
	Compensateur Compensator	Repos / Rest	Equilibre / Balance $P_p=40\text{bar}$	Equilibre / Balance $P_p=P_{p1}+20\text{b}$ or $P_p=P_{p2}+20\text{b}$	Equilibre / Balance $P_p=P_{p1}+20\text{b}$ or $P_p=P_{p2}+20\text{b}$



<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

VUES COMPLETTES
COMPLETE SKETCHES

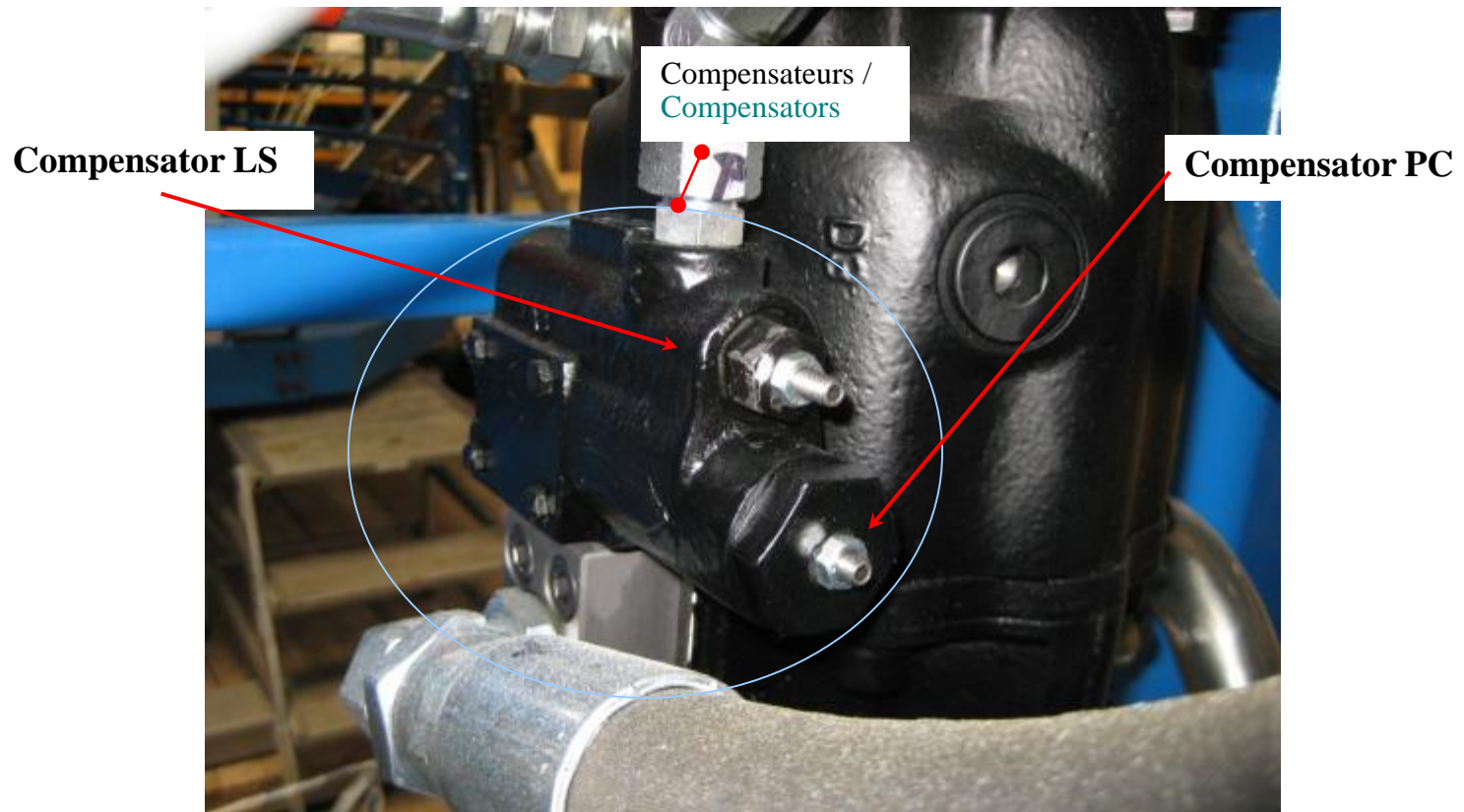


<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

COMPENSATEUR COMPENSATOR

COMPENSATEUR COMPENSATOR

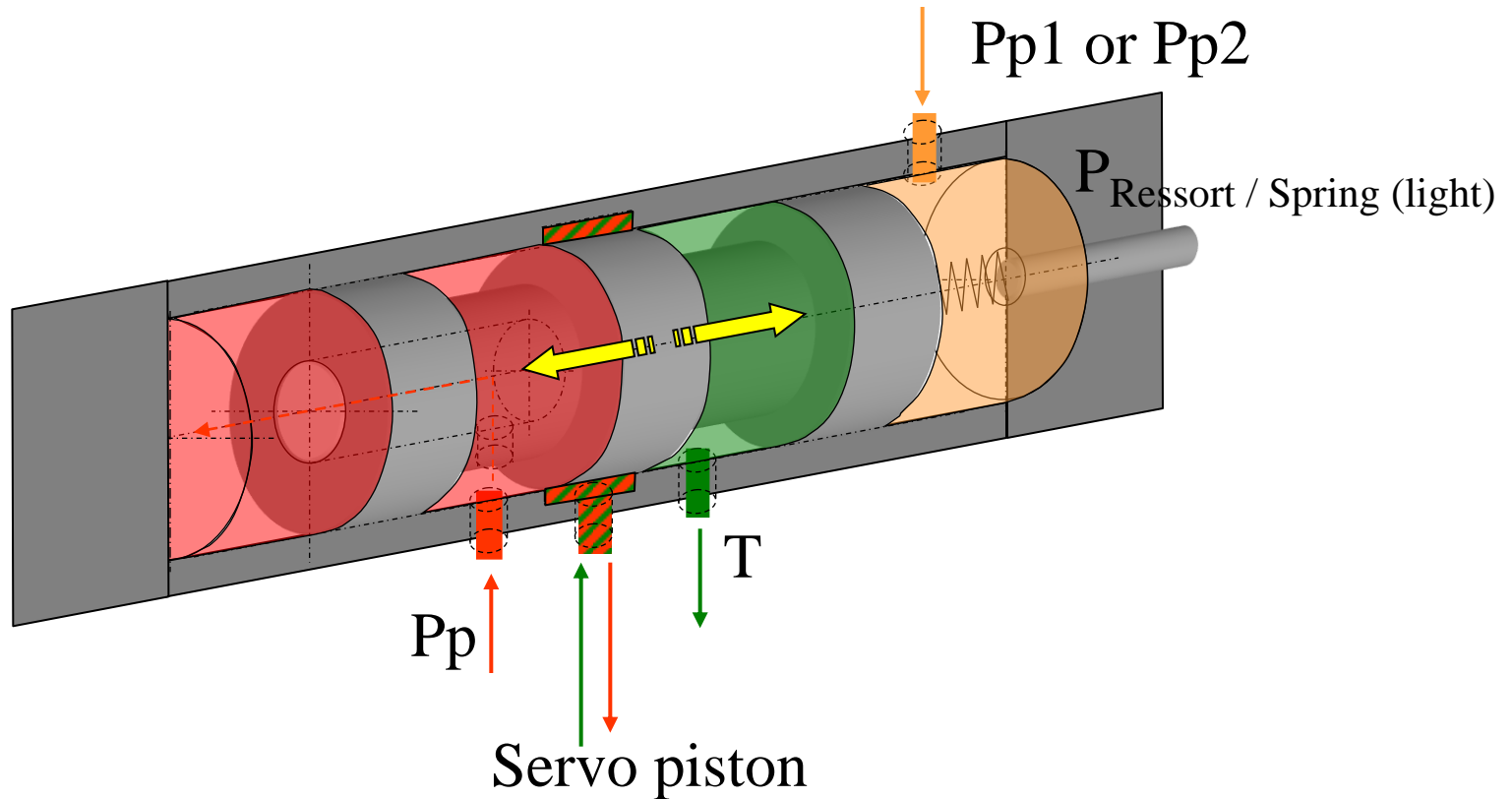


Un compensateur ressemble à un distributeur. La position du tiroir est déterminée par la comparaison de deux pressions: P_p et la plus forte entre P_{p1} et P_{p2}

A compensator looks like a directional valve. The position of the spool depends of the difference between two pressures: P_p and the higher between P_{p1} & P_{p2} .

COMPENSATEUR LS / COMPENSATOR LS

Débit stable / Constant flow



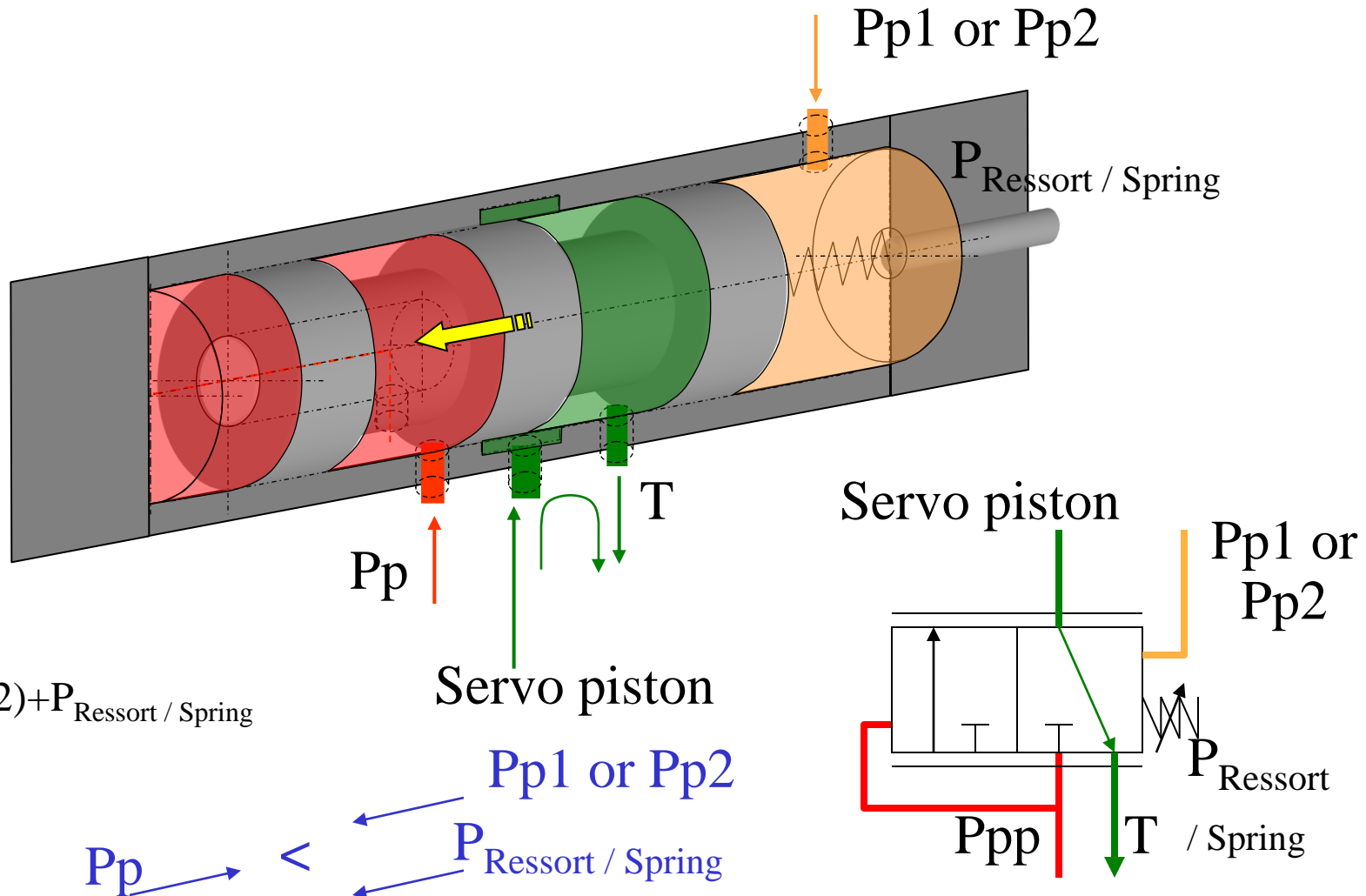
Position d'équilibre / Balance position

$$P_p = (P_{p1 \text{ or } Pp2}) + P_{\text{Ressort / Spring}}$$

$$P_p = P_{\text{Ressort / Spring}} + P_{p1 \text{ or } Pp2}$$

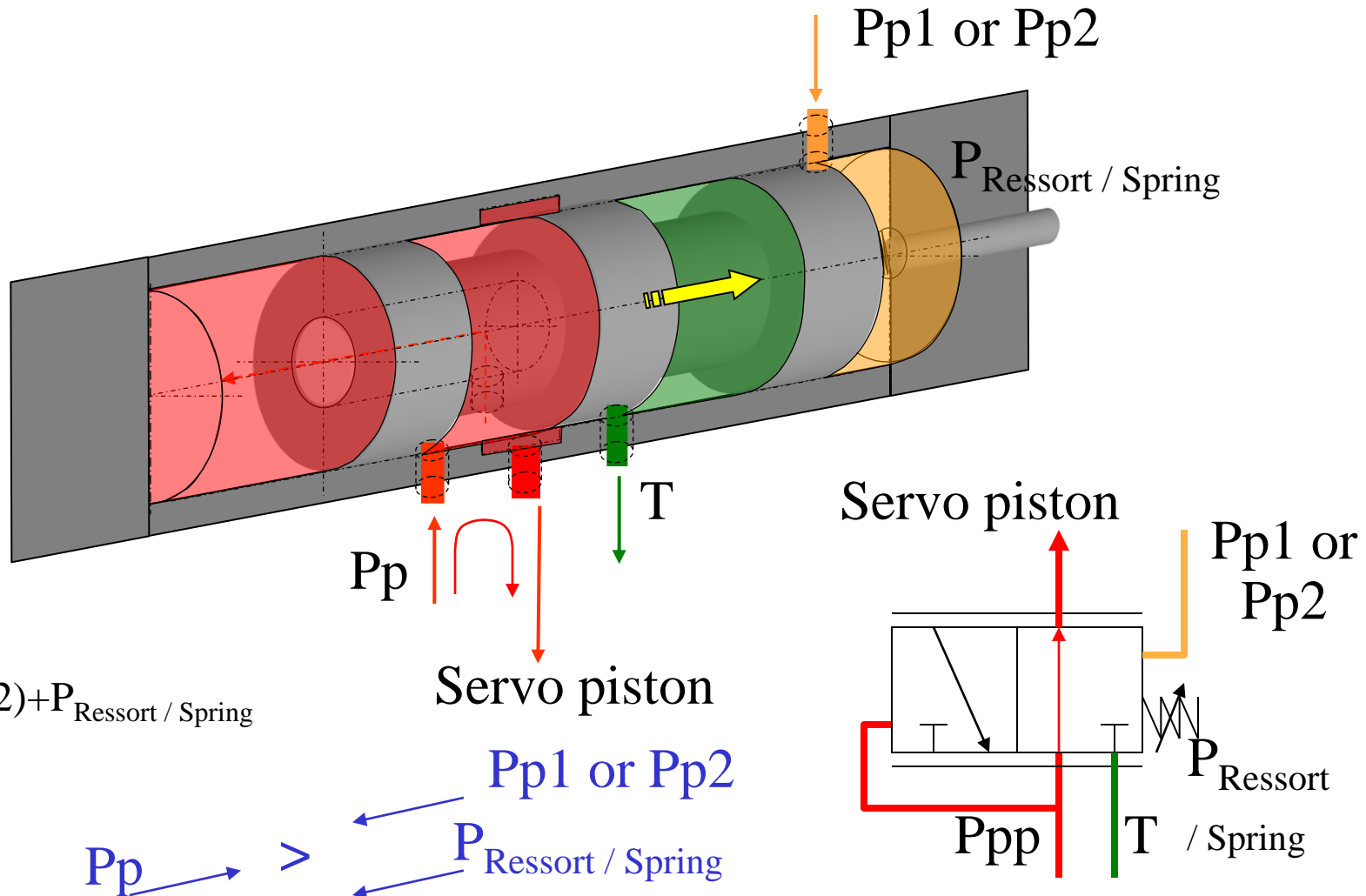
COMPENSATEUR LS / COMPENSATOR LS

Augmentation débit / Flow increase

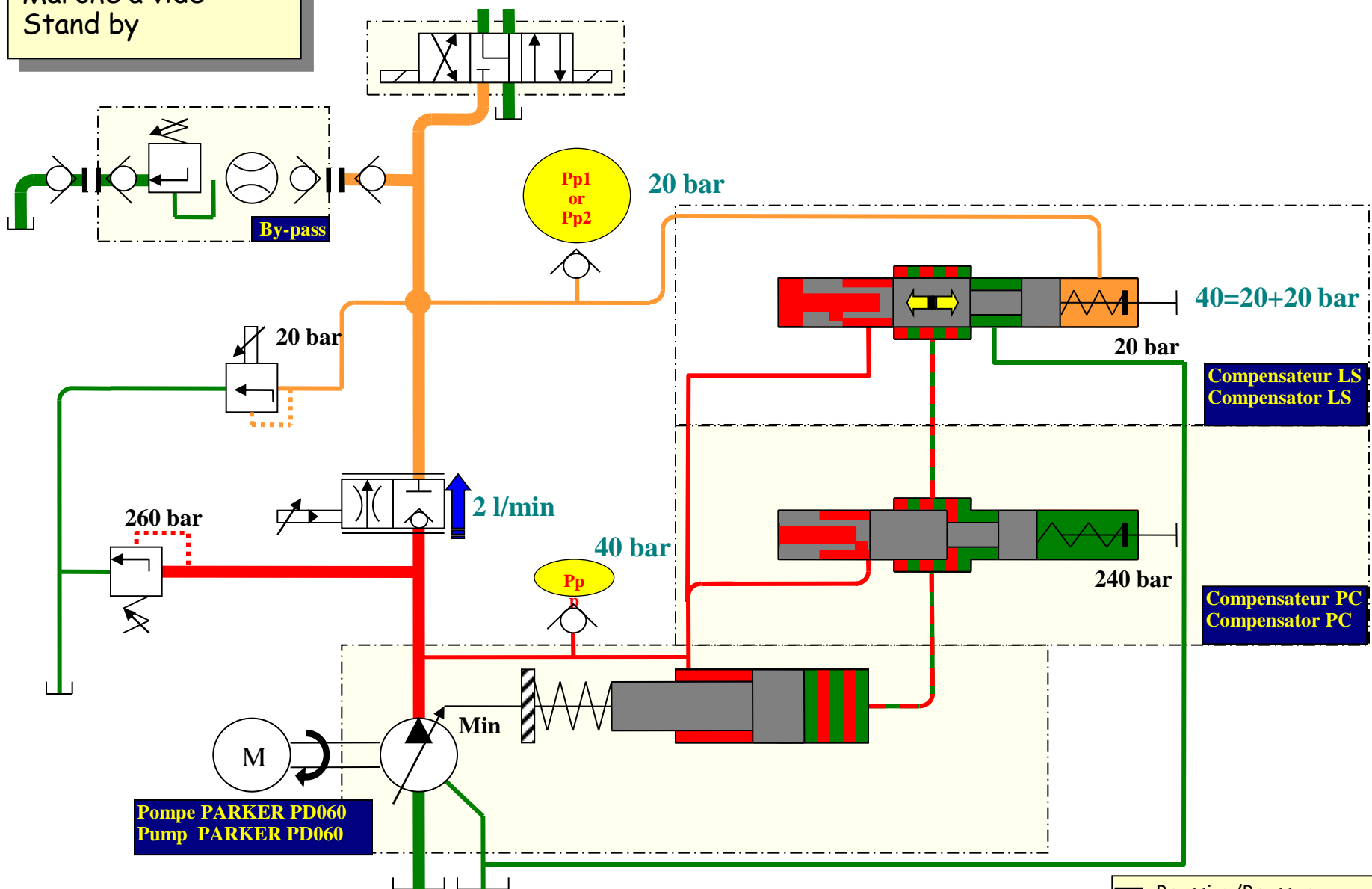


COMPENSATEUR LS / COMPENSATOR LS

Diminution débit / Flow Decrease

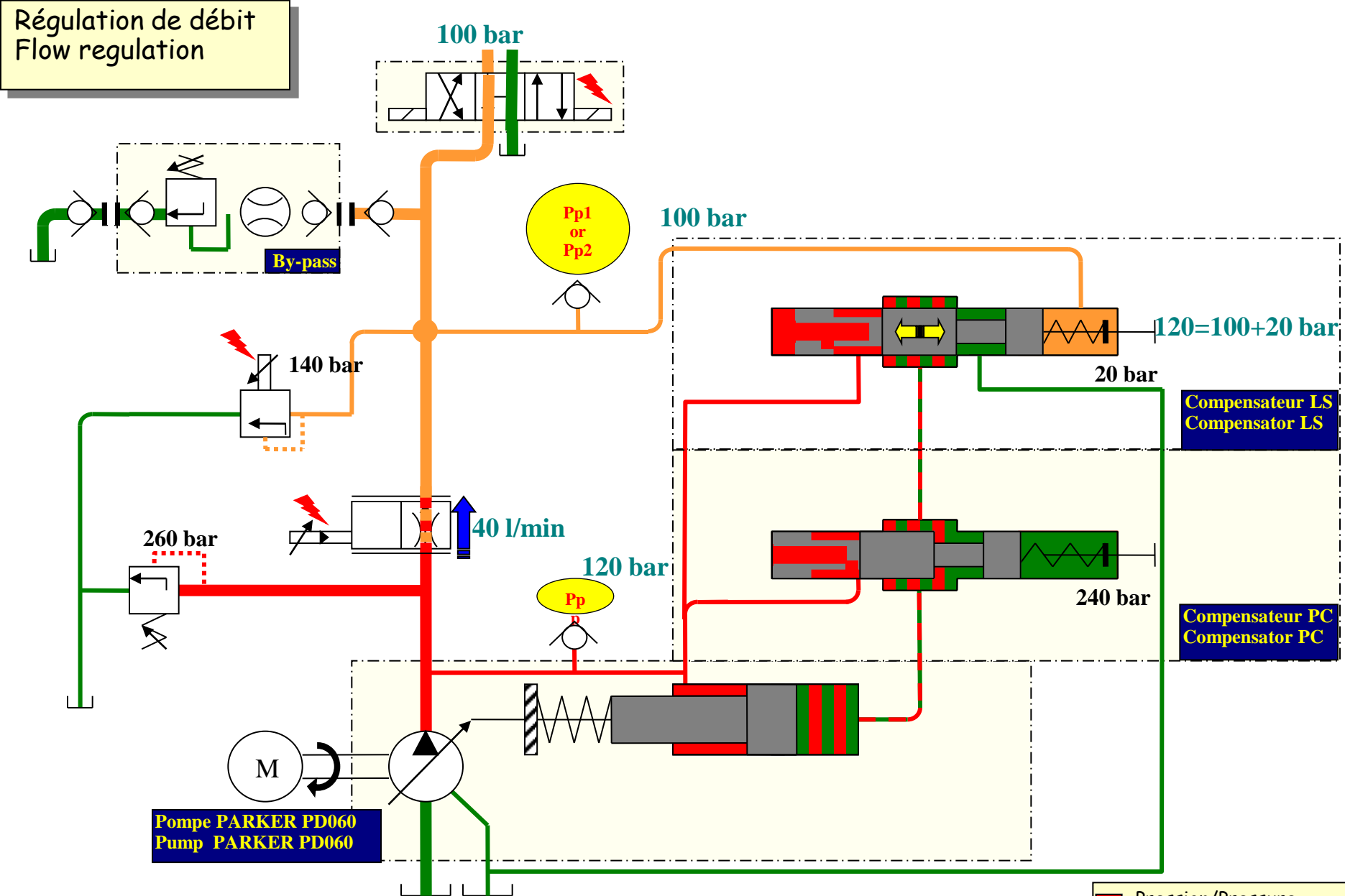


Marche à vide
Stand by



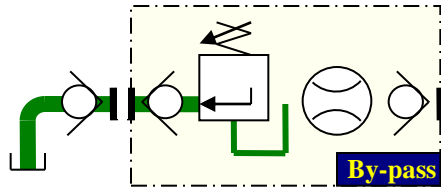
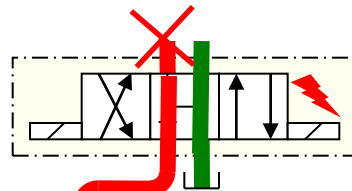
- Pression/Pressure
- Retour réservoir/Tank
- Pression charge/Load
- Circuit principal/Main
- Circuit pilote/Pilot

Régulation de débit
Flow regulation

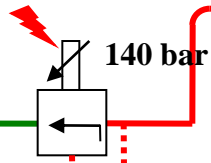


- Pression/Pressure
- Retour réservoir/Tank
- Pression charge/Load
- Circuit principal/Main
- Circuit pilote/Pilot

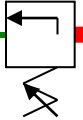
Butée
Bump



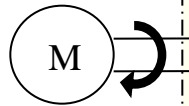
140 bar



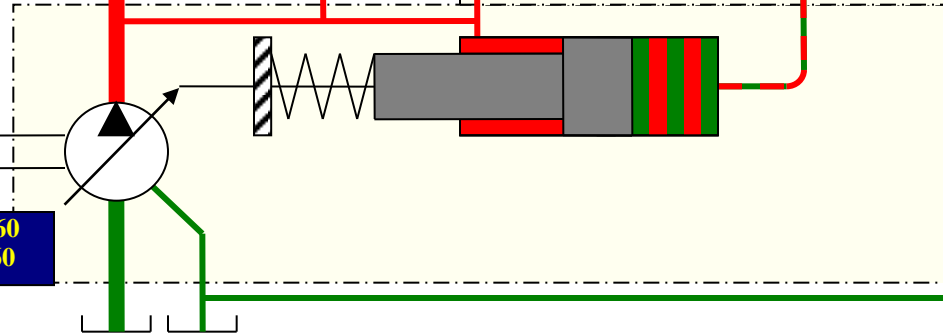
260 bar



160 bar



Pompe PARKER PD060
Pump PARKER PD060



160=140+20 bar

20 bar

Compensateur LS
Compensator LS

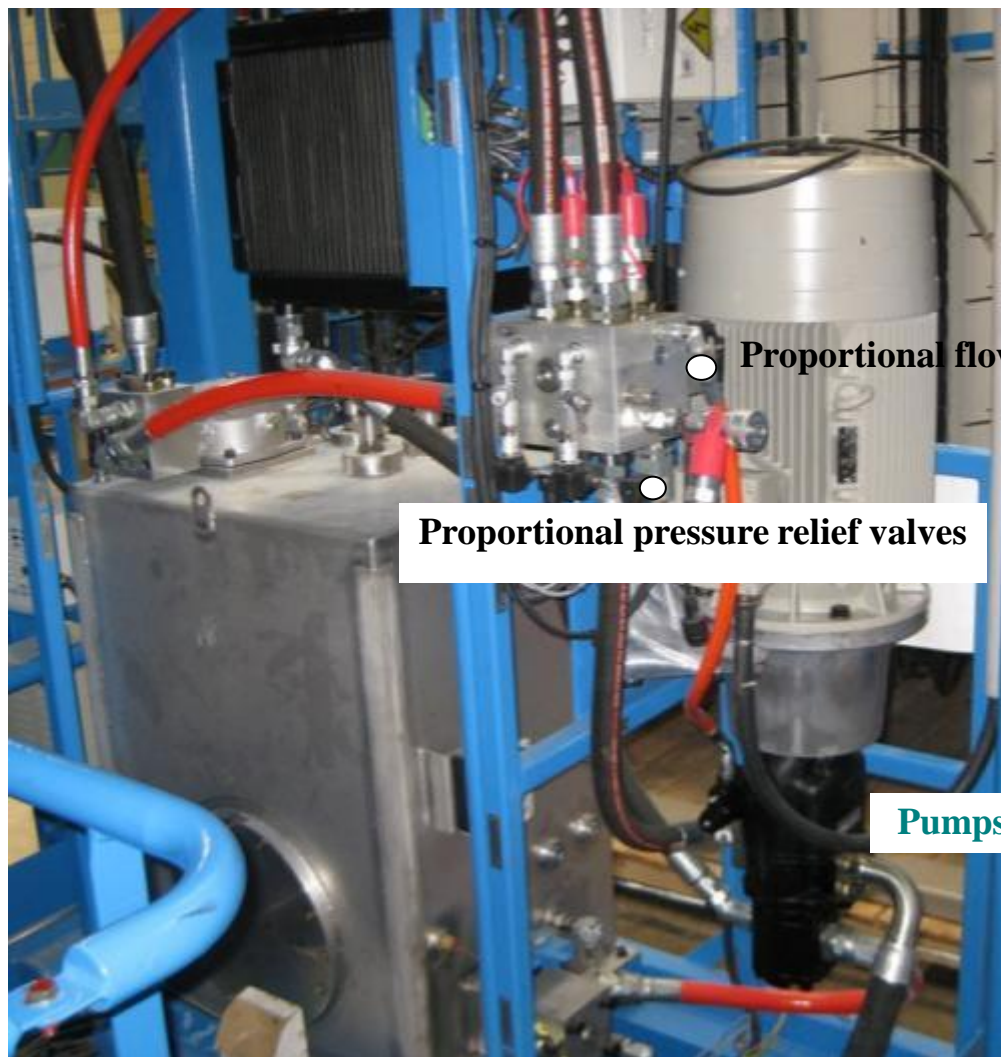


240 bar

Compensateur PC
Compensator PC

- Pression/Pressure
- Retour réservoir/Tank
- Pression charge/Load
- Circuit principal/Main
- Circuit pilote/Pilot

GROUPE DE POMPE PUMP GROUP

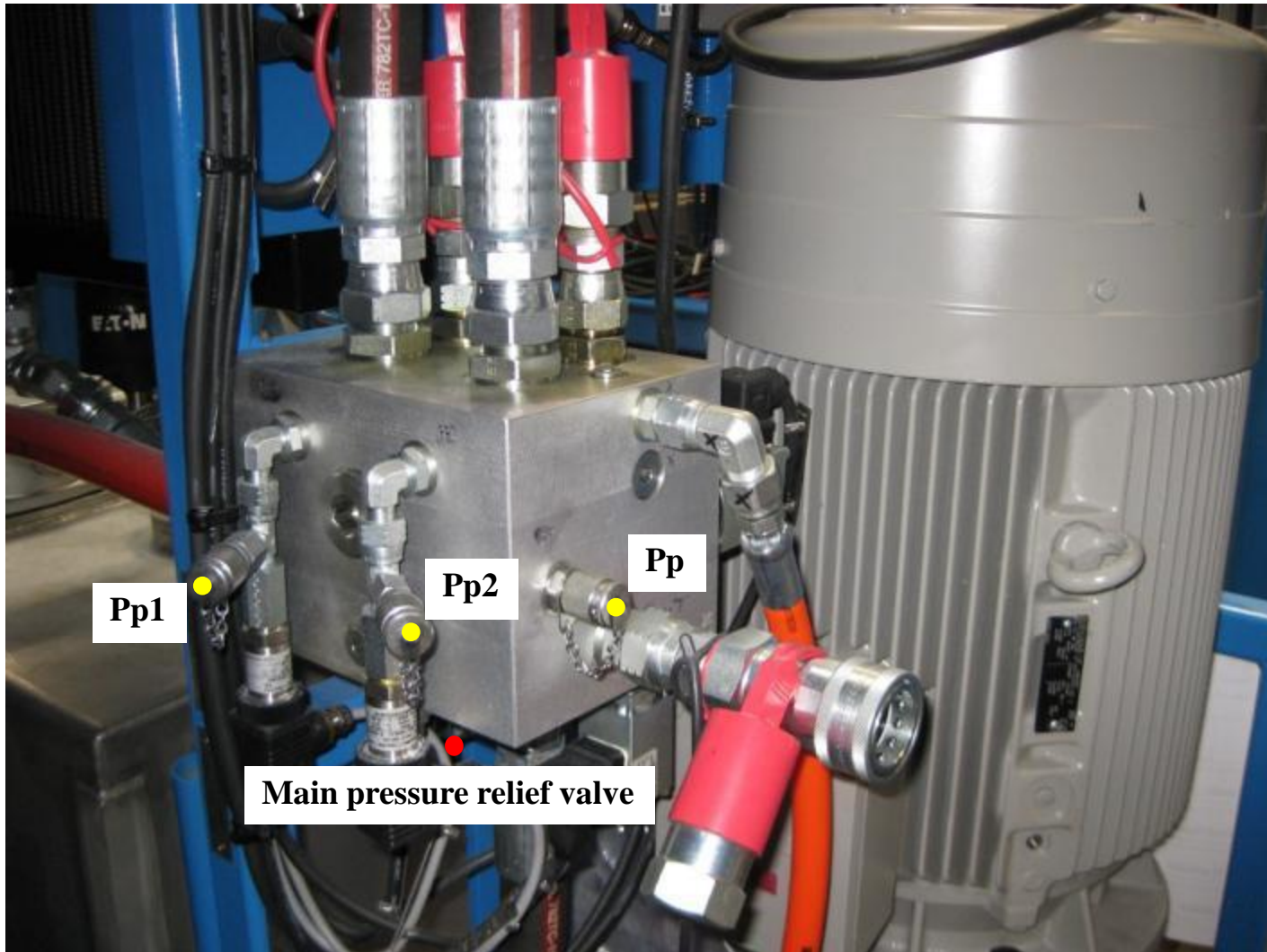


Proportional flow regulators

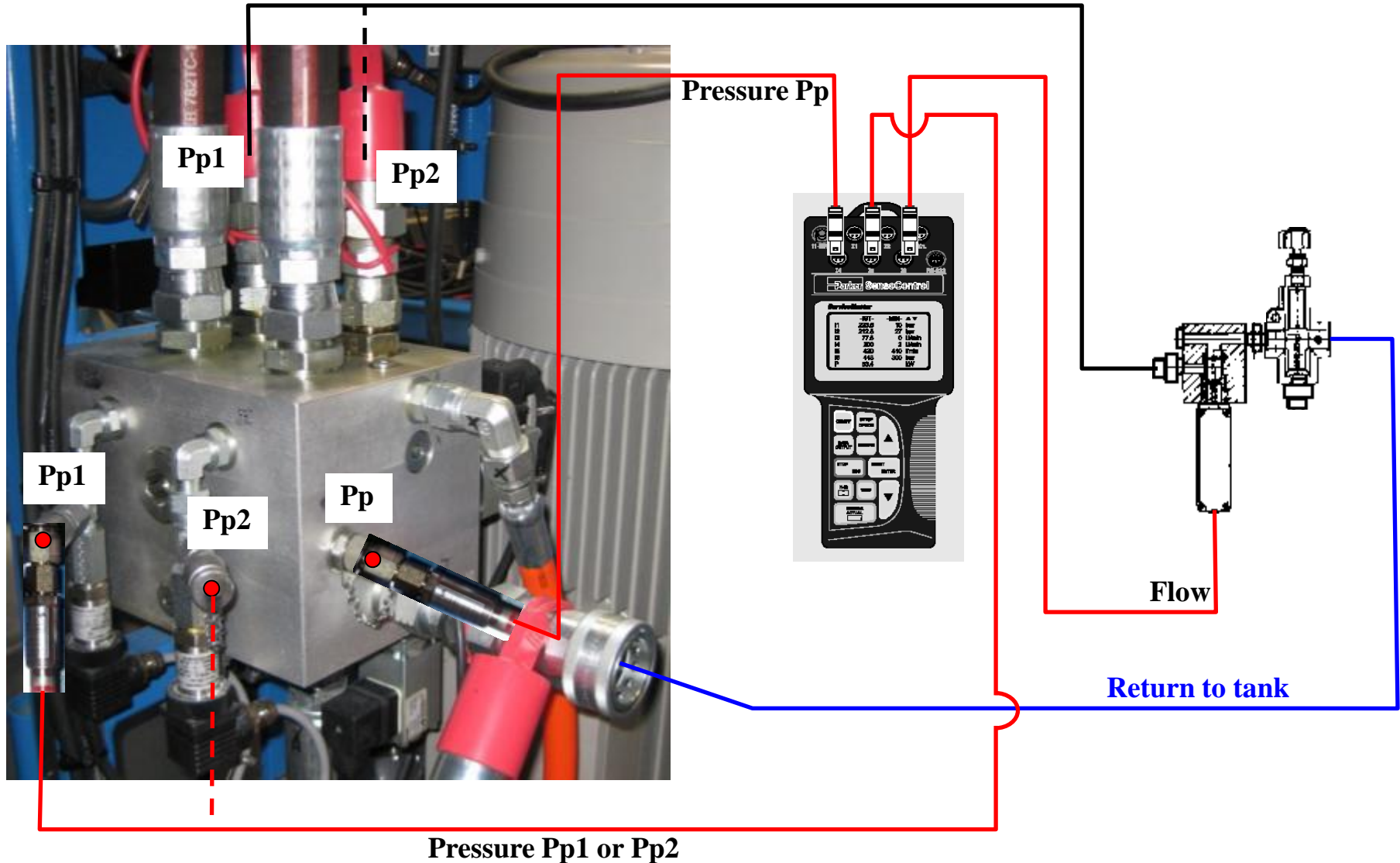
Proportional pressure relief valves

Pumps

GROUPE DE POMPES PUMPS GROUP



CONNEXION DES APPAREILS DE RÉGLAGE CONNECTION OF TOOLS FOR ADJUSTMENT



AJUSTEMENT DES COMPENSATEURS

COMPENSATORS ADJUSTMENT

Réglage du compensateur LS
Compensator LS adjustment

Delta P = 20
+/-2 Bar

Réglage du limiteur de pression
Relief valve adjustment

260 Bar

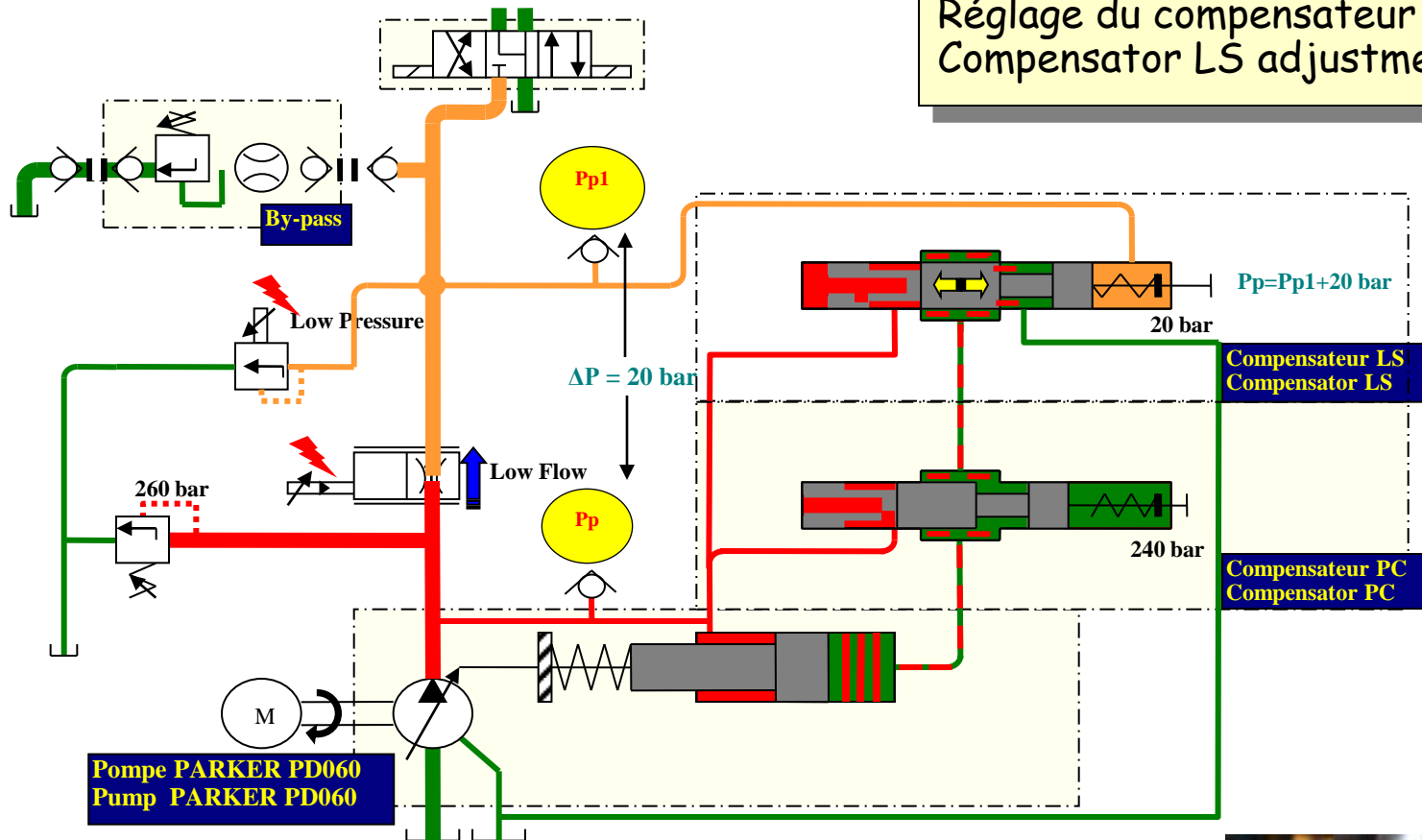
Réglage du module %P et %D
%P & %F module adjustment

I mini = 20 bar / 2 L/min
I max = 250 bar / 65 L/min

Réglage du compensateur PC
Compensator PC adjustment

240 Bar

Réglage du compensateur LS Compensator LS adjustment



Starting motor

Select HU calibration view on Panel View (Line P1 or Line P2)

By-pass circuit open

1 Mvt activated (5 V in pressure)

1 Mvt activated (6 V in flow)

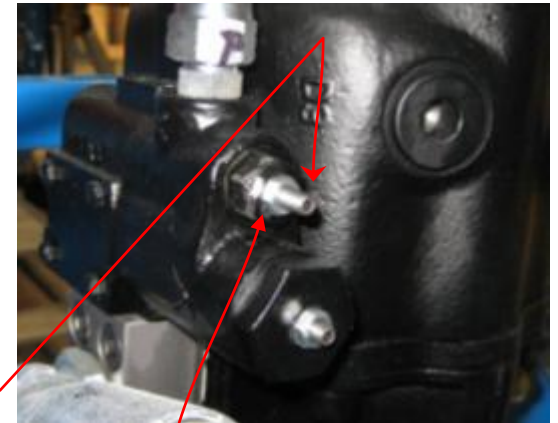
Adjust bypass to obtain **50 bars** on Pp1 or Pp2

Adjust flow setting to obtain **30 L/min**

Adjust ΔP between Pp & Pp1/Pp2. ΔP must be at 20 (+/-2) bar

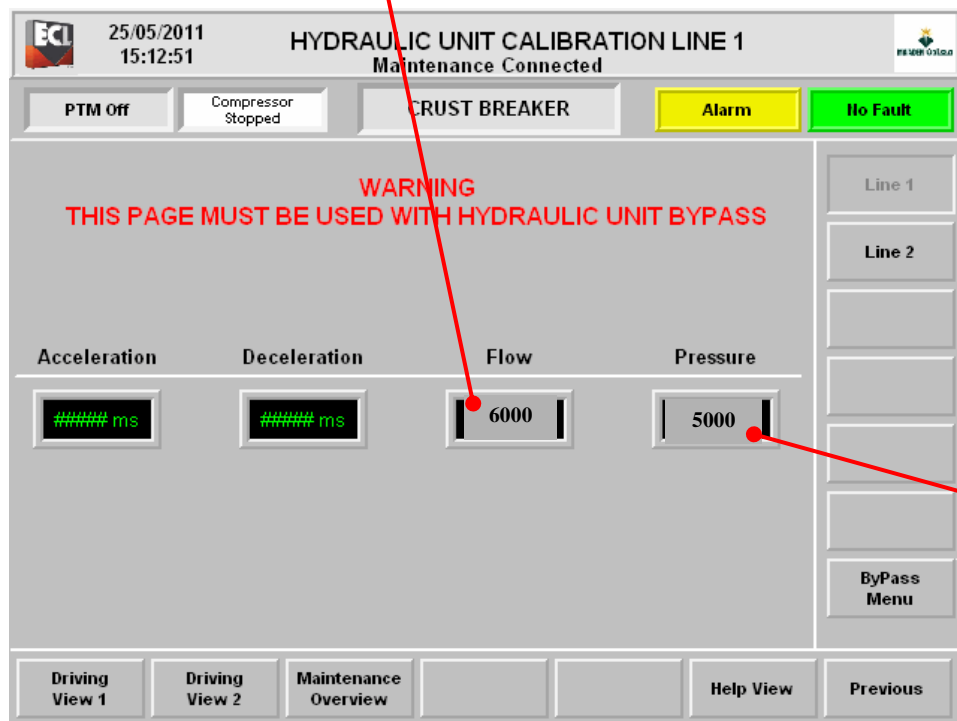
Lock with nut

NOTA: Always finish the adjustment by tightening (clockwise direction)

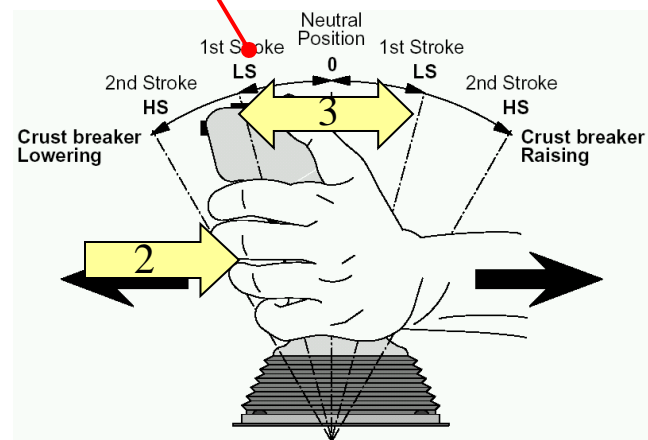


- 1 Mvt activated (6 V in flow)
- Adjust flow setting value to obtain 30 l/mn

Réglage du compensateur LS
Compensator LS adjustment

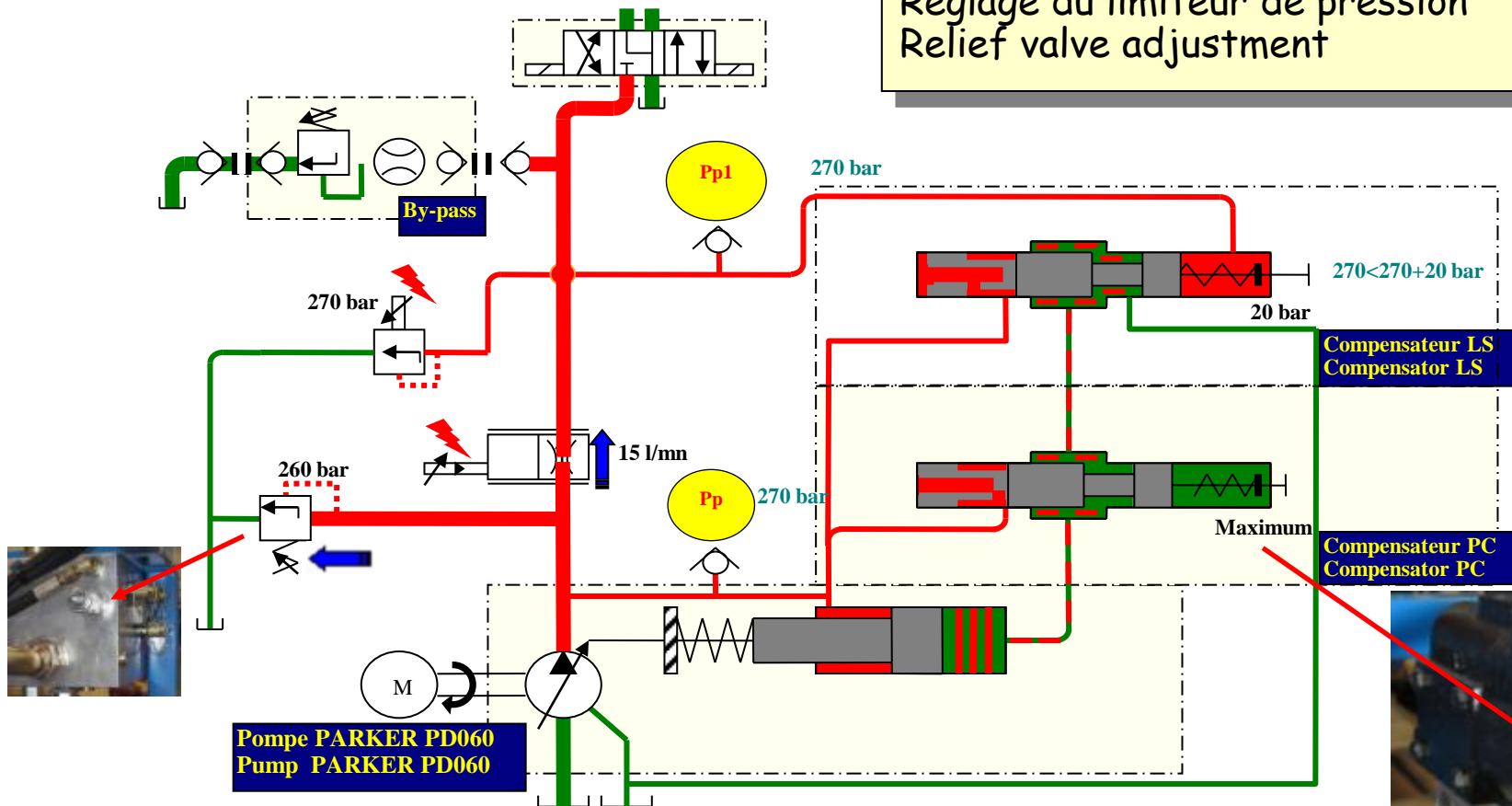


1 Mvt activated (5 V in pressure)



Select calibration view for Line P1 or Line P2

Réglage du limiteur de pression Relief valve adjustment



Before starting the motor

1. Select HU calibration view on Panel View
2. By-pass circuit open
3. Tighten the safety valve at maximum
4. Tighten the compensator PC at maximum
5. 1 Mvt activated (4 V in pressure)

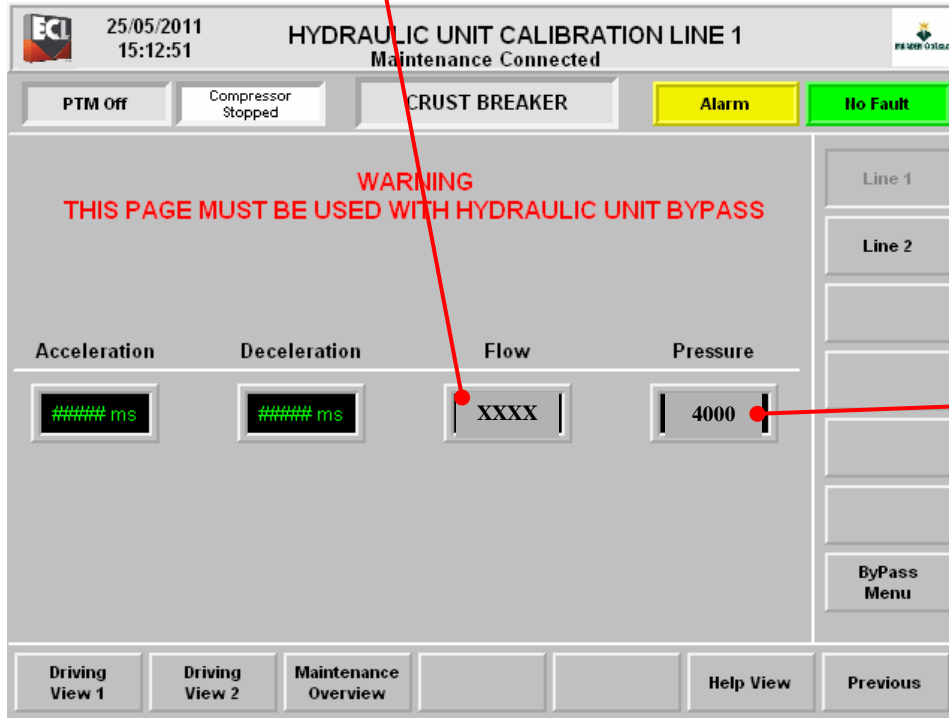
Starting motor

6. Adjust flow setting to obtain **15 L/min**
7. Tighten fully pressure limiter on By-pass
8. Adjust the pressure set value to obtain $260 + 10 \text{ bar} = 270 \text{ bar}$ on Pp1 or Pp2

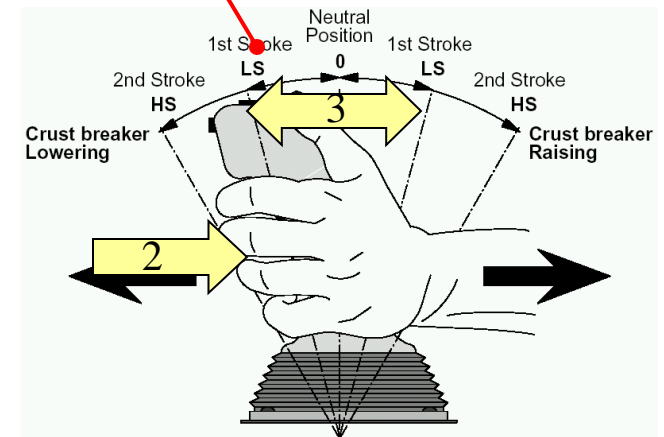
9. Read the motor current on the clamp meter
 10. Loosen the safety valve until to see an increasing of the motor current value, that involves a light decreasing of the pressure : the opening point is adjusted
 11. Open fully pressure limiter on By-pass
- NOTA: Always finish the adjustment by tightening (clockwise direction)**

Adjust flow setting value to obtain 15 l/mn

Réglage du limiteur de pression
Relief valve adjustment



- 1 Mvt activated (4 V in pressure)
- Adjust pressure setting value to obtain 270 bar



Select calibration view for Line 1 or Line 2

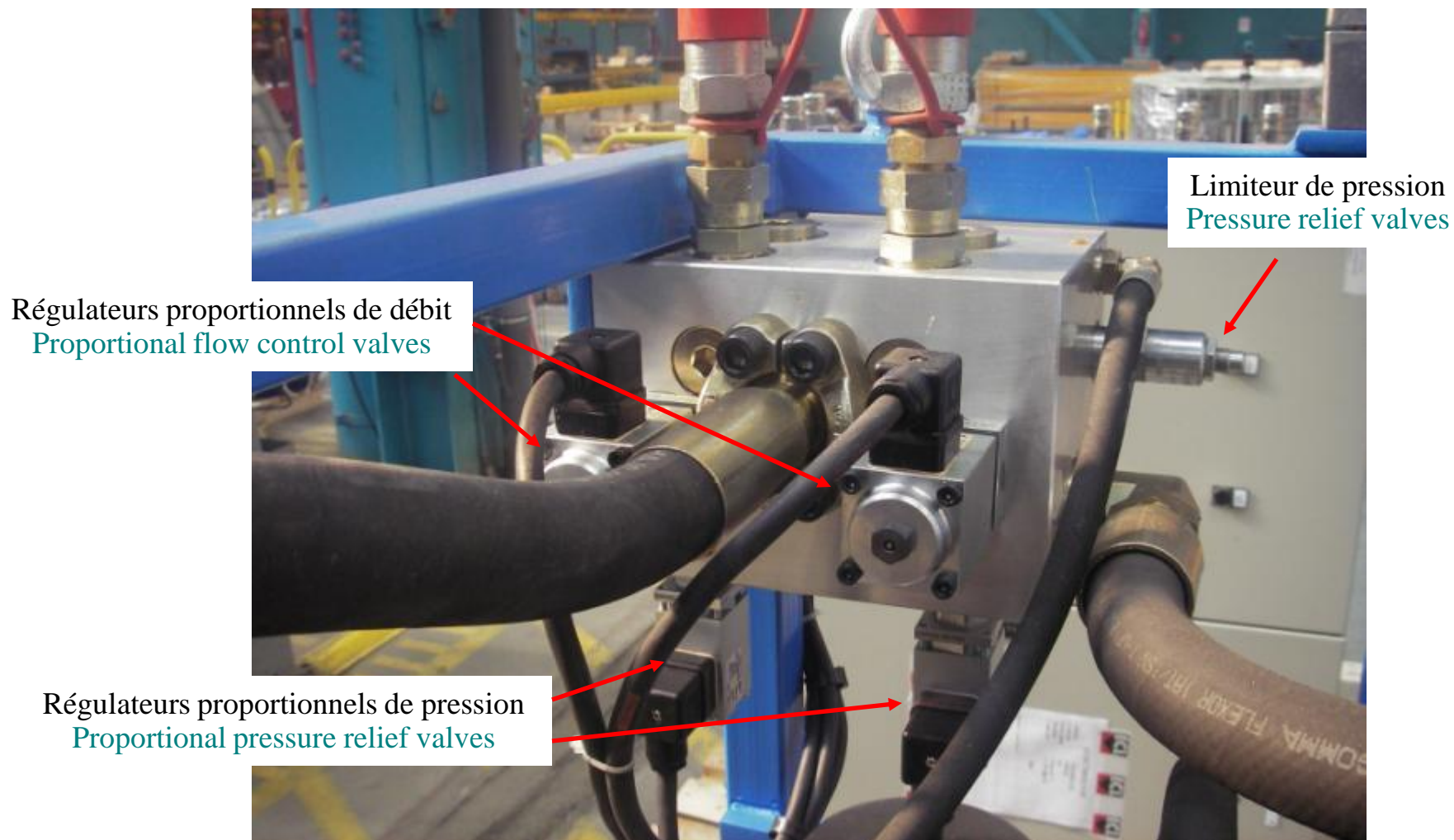


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EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

REGLAGES
MODULES DEBIT - PRESSION
ADJUSTMENT
FLOW & PRESSURE
MODULES

BLOC DE REGULATION REGULATION MANIFOLD



MODULES DEBITS / PRESSIONS

FLOW / PRESSURE MODULES



**PC CONNECTION
FOR LINE P1**

Flows and pressures settings
comes from PLC analogic Output

Red LED
Fault

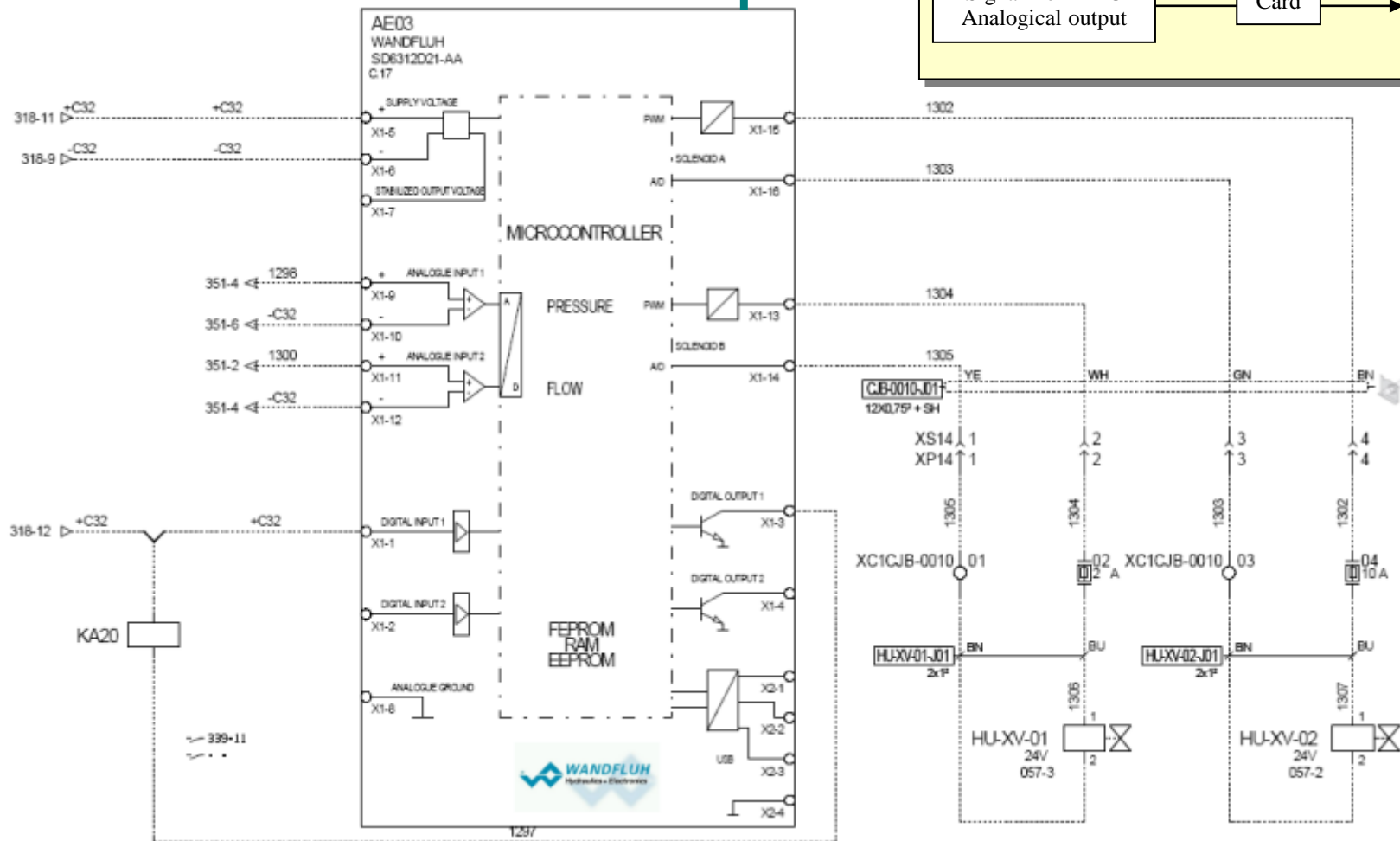
Yellow LED
Running

Green LED
Power ON

**PC CONNECTION
FOR LINE P2**

MODULE “SD6312 D21 AA” (débit, pression)

MODULE “SD6312 D21 AA” (flow. pressu



Signal from PLC
Analogue output

Card

BVP

CONSIGNES DEBITS / PRESSIONS FLOW / PRESSURE SETTINGS

Start the software :
"C:\Program Files\PasoDSVSD6v1502\Paso.exe"



**PASO DSV / SD6
for Windows**

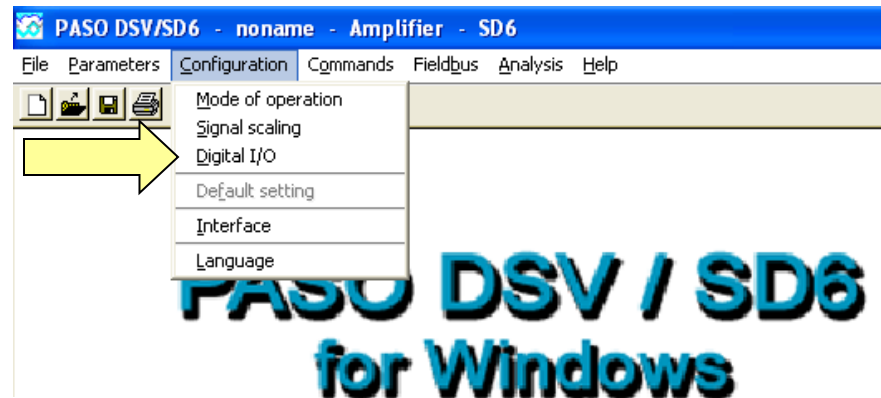


Ethernet Cable (RJ45)

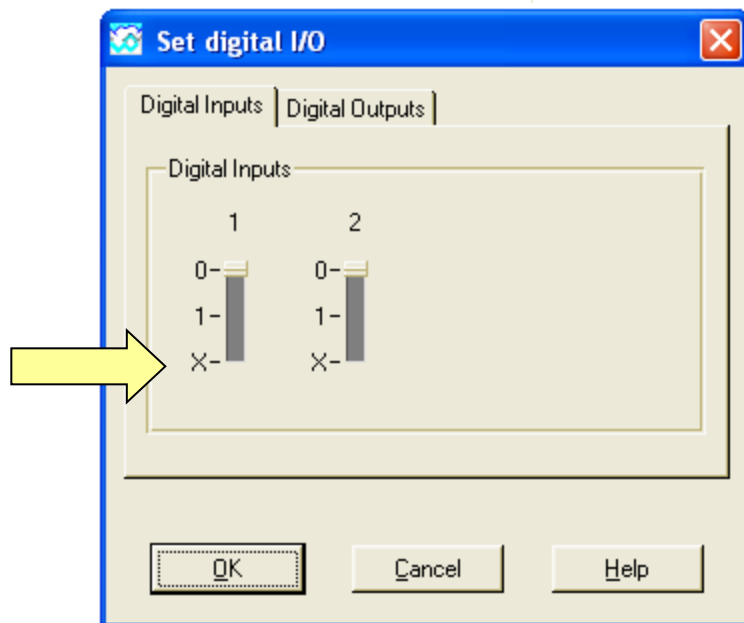
CONSIGNES DEBITS / PRESSIONS

FLOW / PRESSURE SETTINGS

1 - Select « Digital I/O »



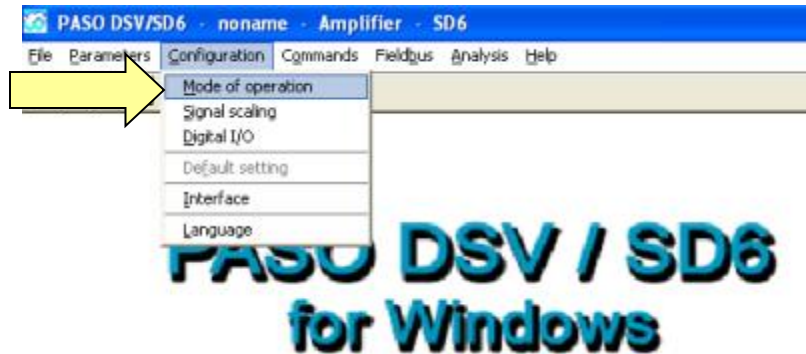
2 - Move to x



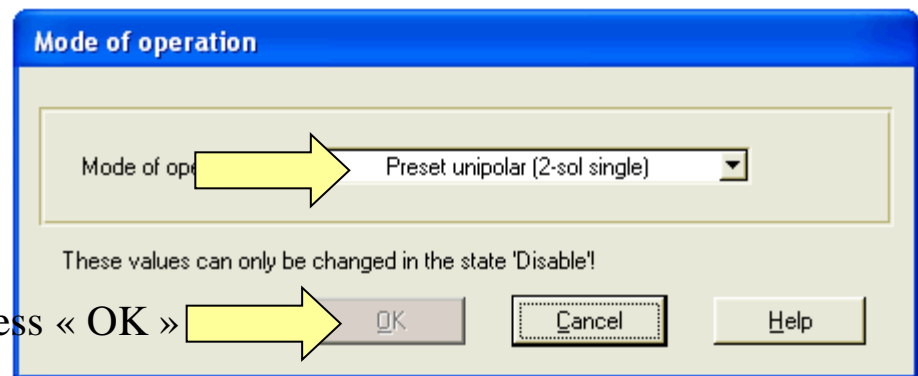
3 - Green LED
Power ON
ONLY

CONSIGNES DEBITS / PRESSIONS FLOW / PRESSURE SETTINGS

1 - Select « Mode of operation »



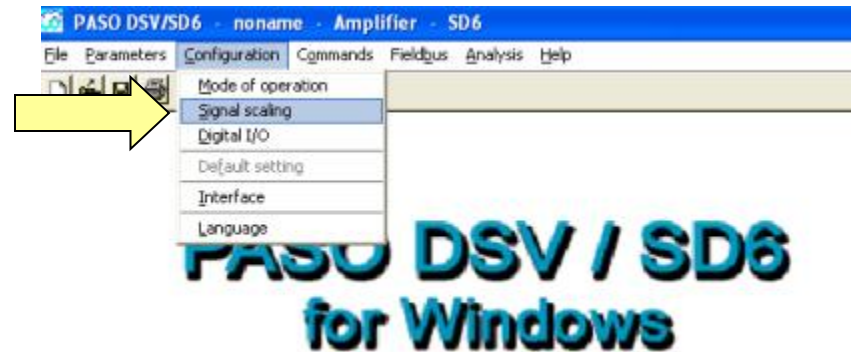
2 – Select « Preset unipolar (2-sol single) »



3 – Press « OK »

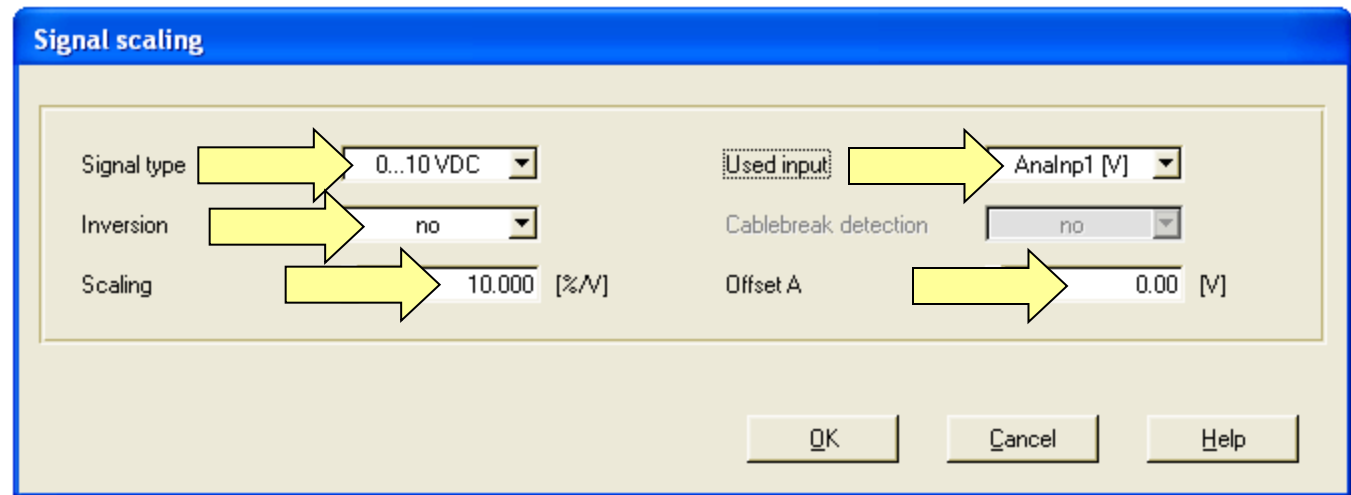
CONSIGNES DEBITS / PRESSIONS FLOW / PRESSURE SETTINGS

1 - Select « Signal scaling »



Chanel A & B identical

2 – Set up



CONSIGNES DEBITS / PRESSIONS

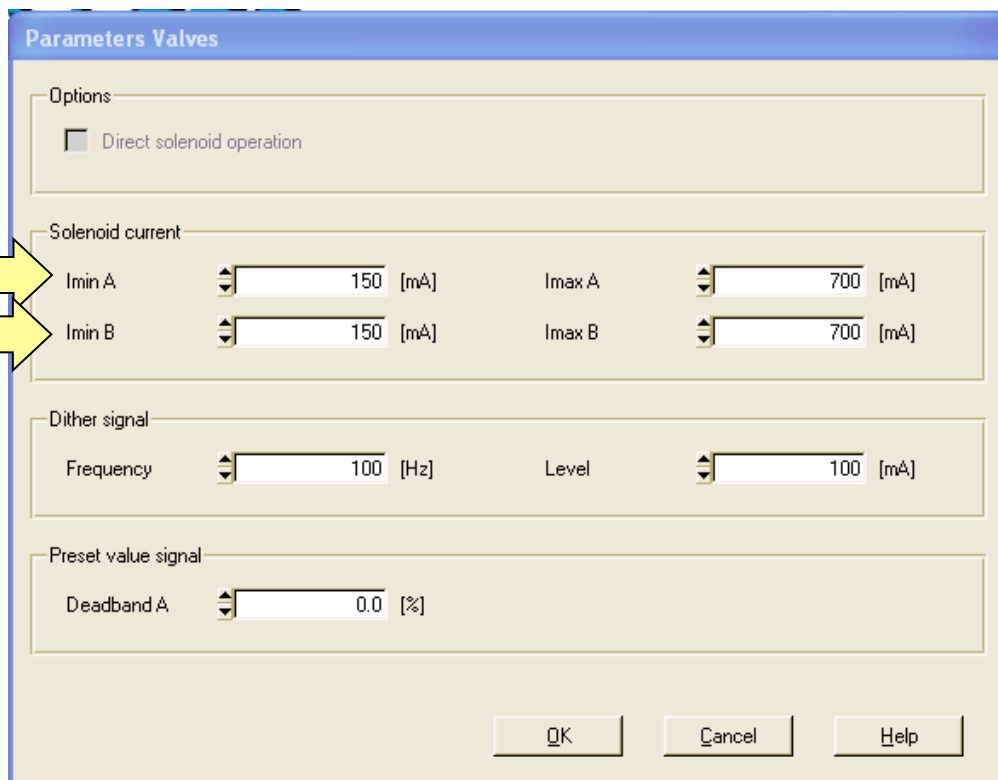
FLOW / PRESSURE SETTINGS

1 - Select « Valves »



PASO DSV / SD6
for Windows

Pressure valve A
Flow valve B



Parameters Valves

Options

☐ Direct solenoid operation

Solenoid current

Imin A: 150 [mA] Imax A: 700 [mA]

Imin B: 150 [mA] Imax B: 700 [mA]

Dither signal

Frequency: 100 [Hz] Level: 100 [mA]

Preset value signal

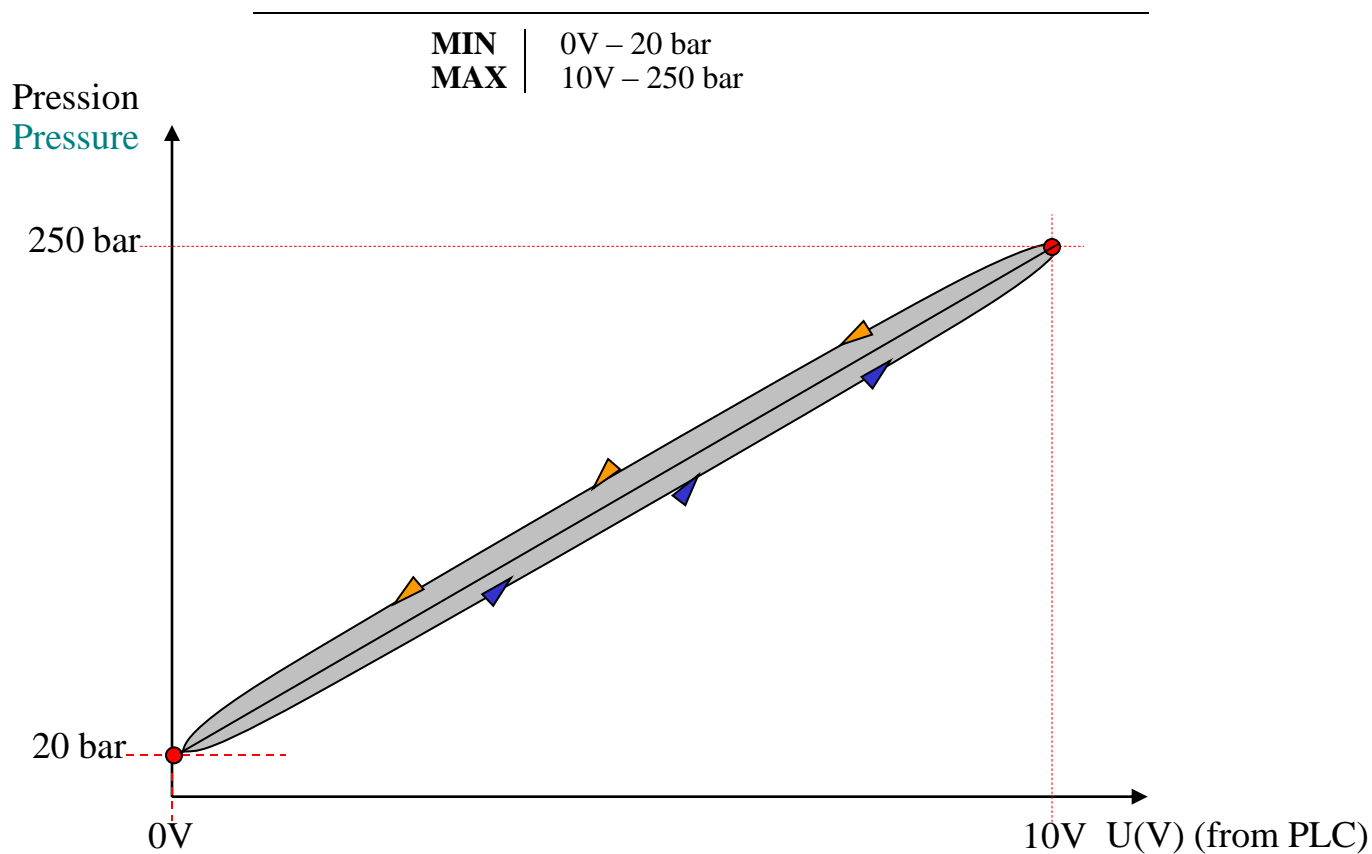
Deadband A: 0.0 [%]

OK Cancel Help

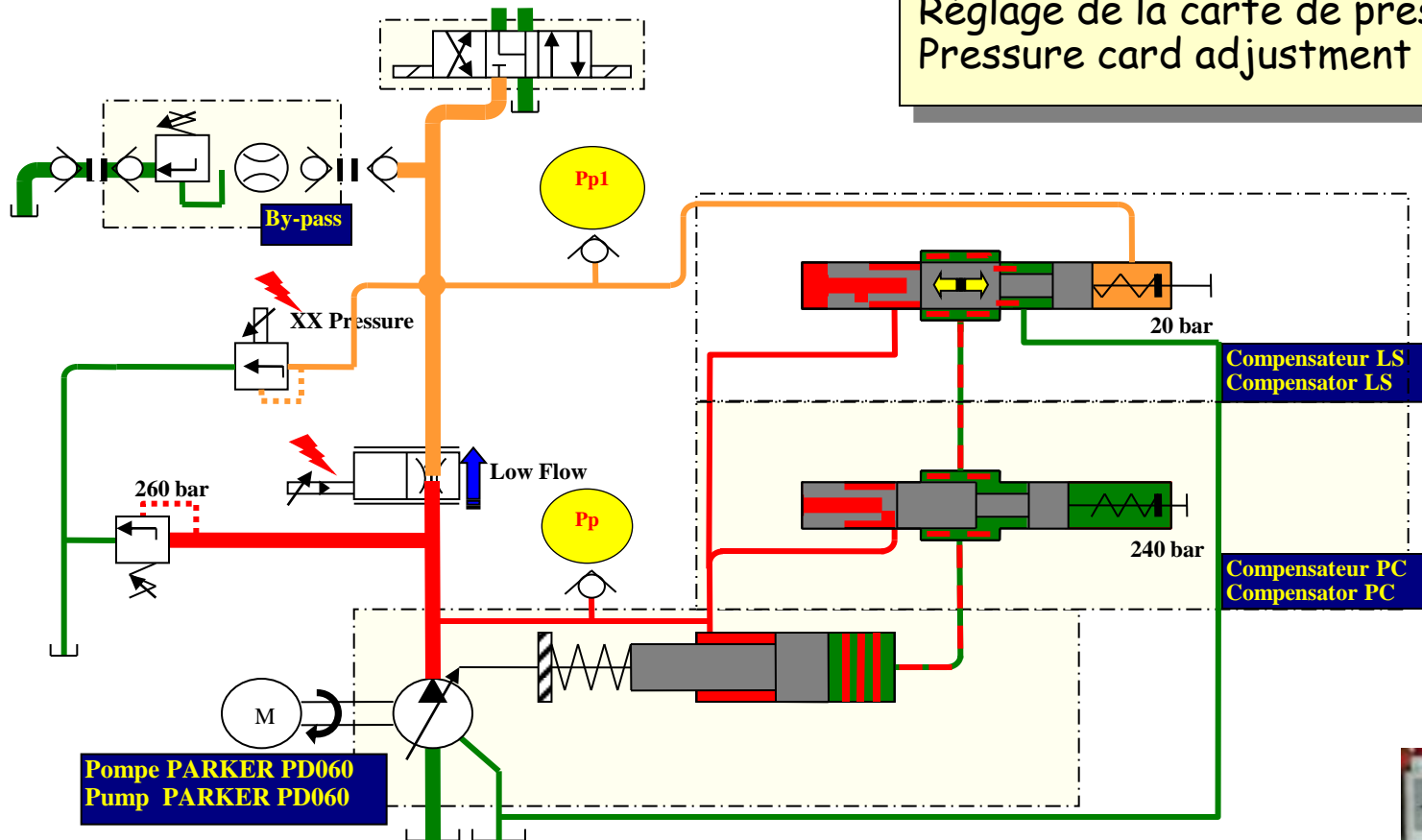
Ajustement pression

Pressure Adjustment

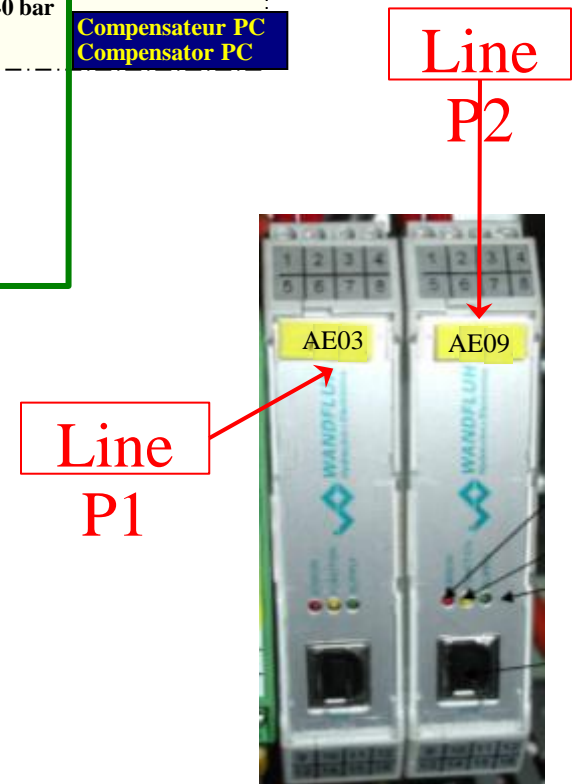
Ajustement du point d'ouverture et de l'ouverture maximale de la valve BVP
Adjustment of the opening point and the maximum opening of the BVP valve



Réglage de la carte de pression Pressure card adjustment

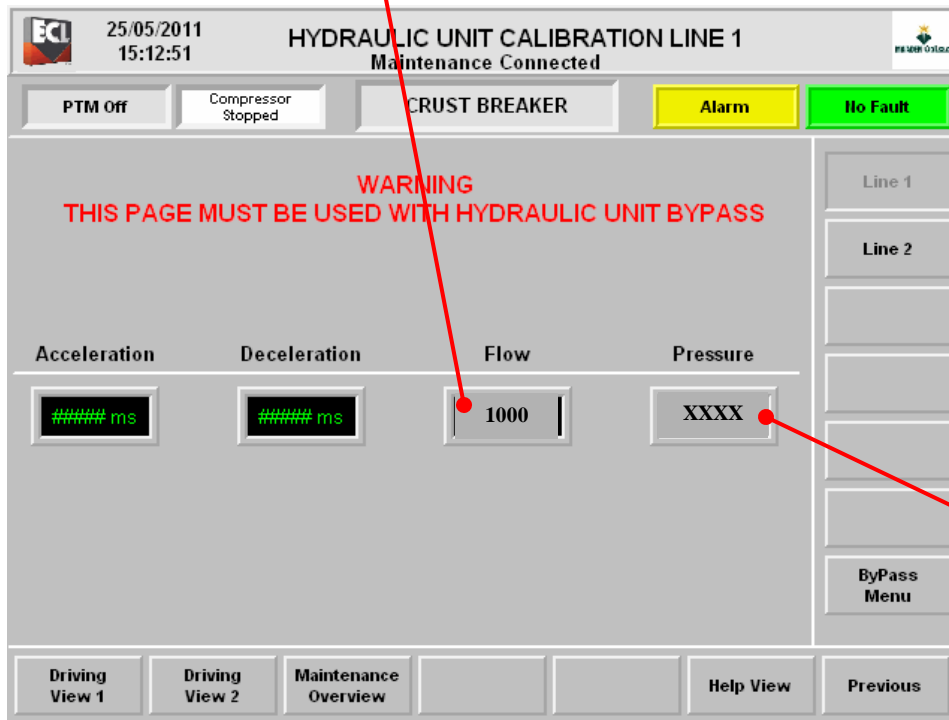


1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. 1 Mvt activated (1 V in flow)
3. Adjust the pressure setting value to 0V on Panel view
4. Tighten fully pressure limiter on By-pass
5. Adjust the I Min A to obtain 20 bar on Pp1 or Pp2
6. Adjust the pressure setting value to 10V on Panel view
7. Adjust the I Max A to obtain 250 bar on Pp1 or Pp2 (Approx. 500 mA)
8. Verify 0V → 20 bar
9. Verify 10V → 250 bar
10. Auto adjust of analogical pressure sensor



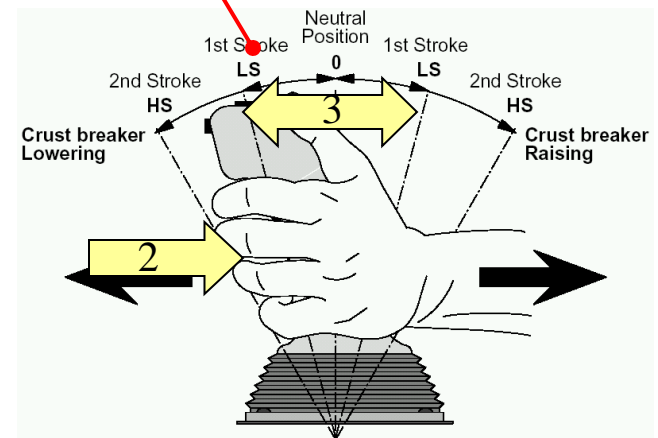
Réglage de la carte de pression Pressure card adjustment

Adjust flow setting at 1 V



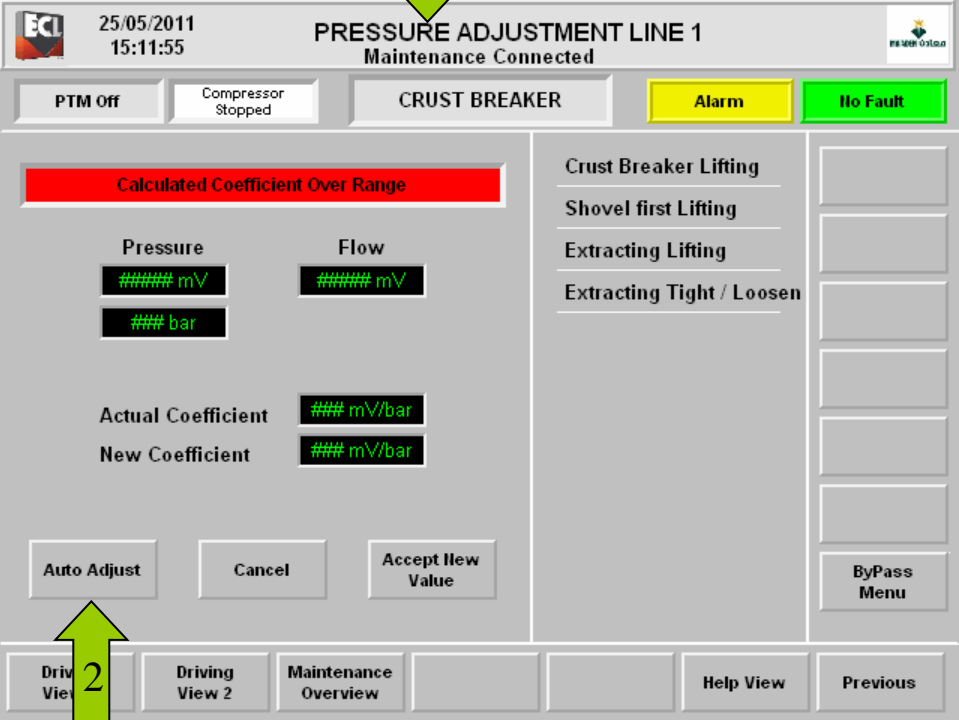
1 Mvt activated (0V or 10V in pressure)

Select calibration view for Line 1 or Line 2



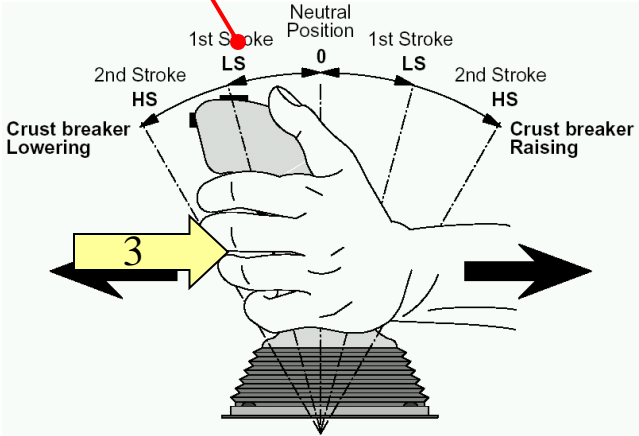
Select pressure adjustment view for Line 1 or Line 2

Réglage capteur pression
Pressure sensor adjustment



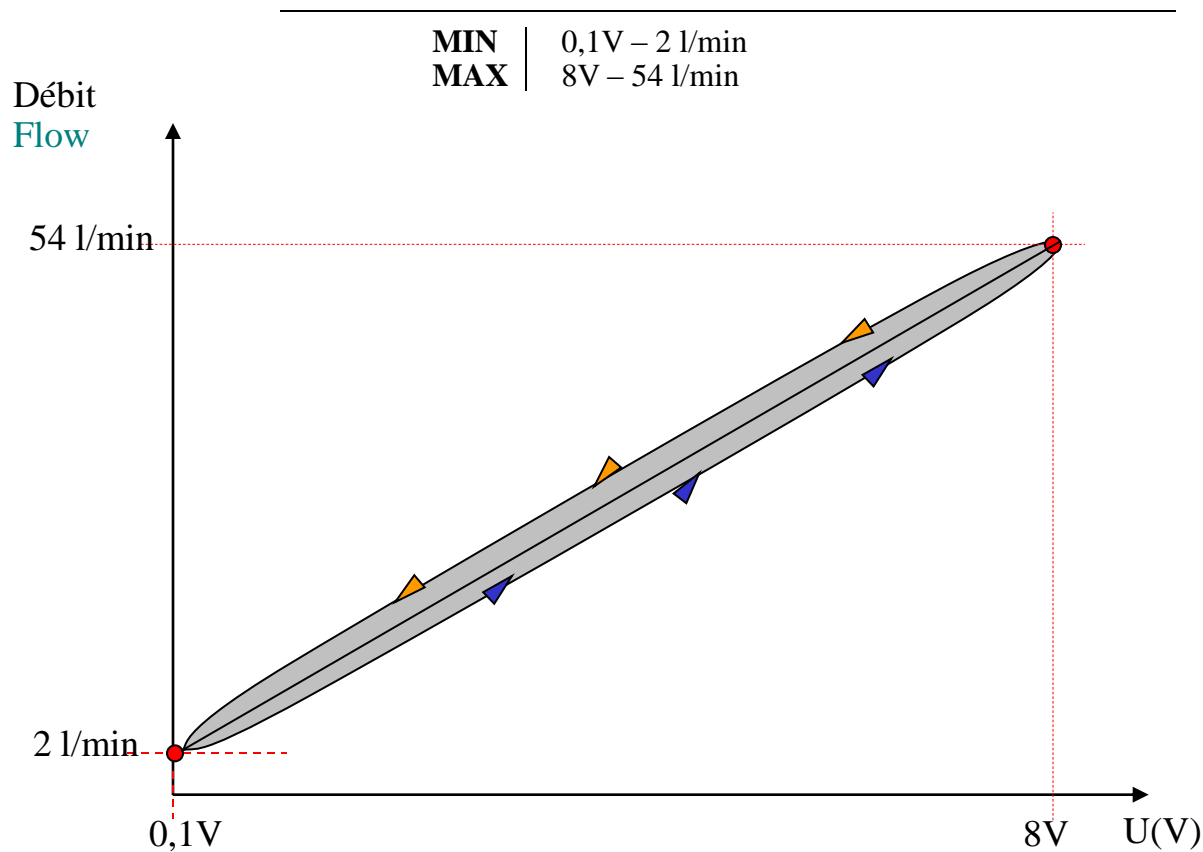
Press Auto Adjust button for Line 1 or Line 2

Press dead man only

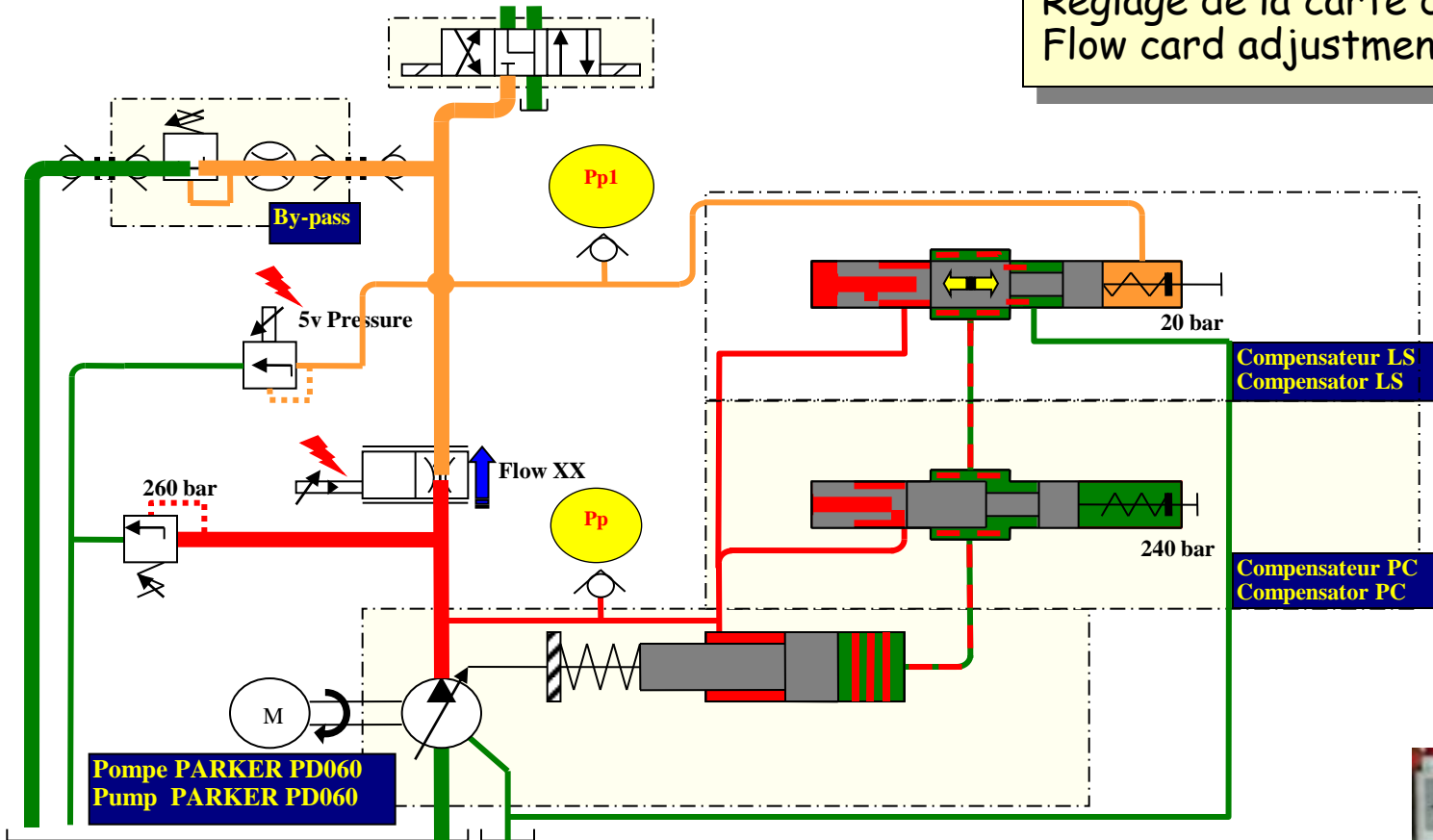


Ajustement débit Flow adjustment

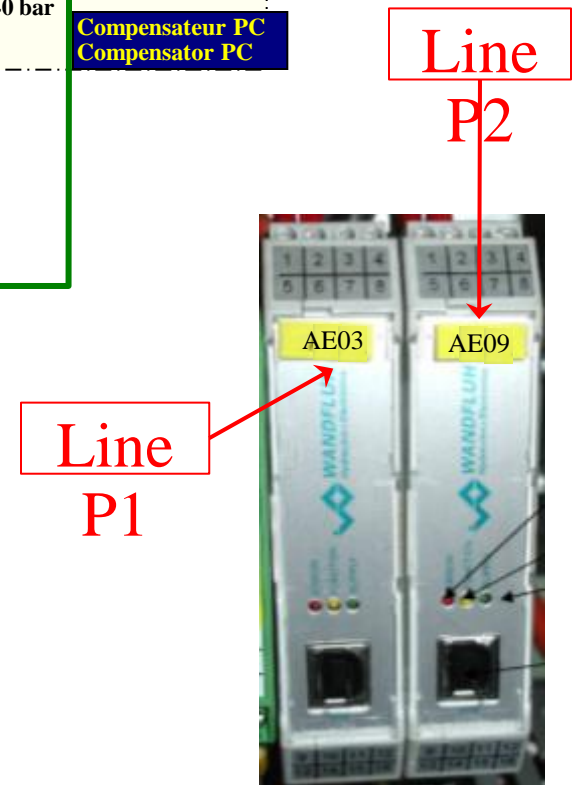
Ajustement du point d'ouverture et de l'ouverture maximale de la valve QNP
Adjustment of the opening point and the maximum opening of the QNP valve



Réglage de la carte de débit Flow card adjustment

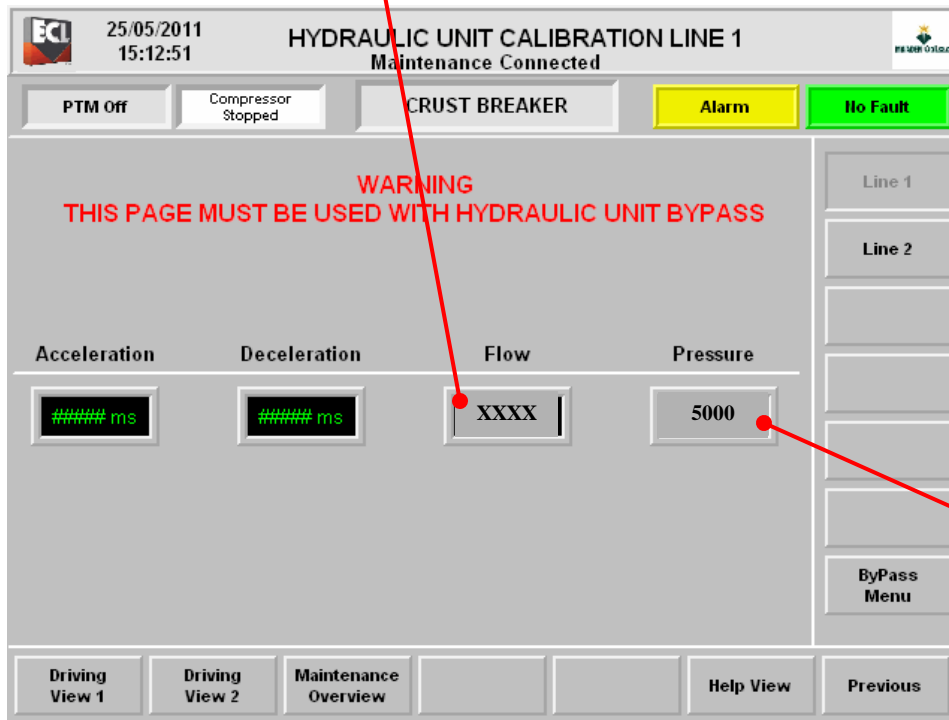


1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. Open fully pressure limiter on By-pass
3. 1 Mvt activated (5 V in pressure)
4. Adjust the flow setting value to 0,1V on Panel view
5. Adjust the I Min B to obtain 2 l/min on the flow meter
6. Adjust the flow setting value to 8V on Panel view
7. Adjust the I Max B to obtain 54 l/min on the flow meter
8. Verify 0,1V → 2 l/min
9. Verify 8V → 54 l/min

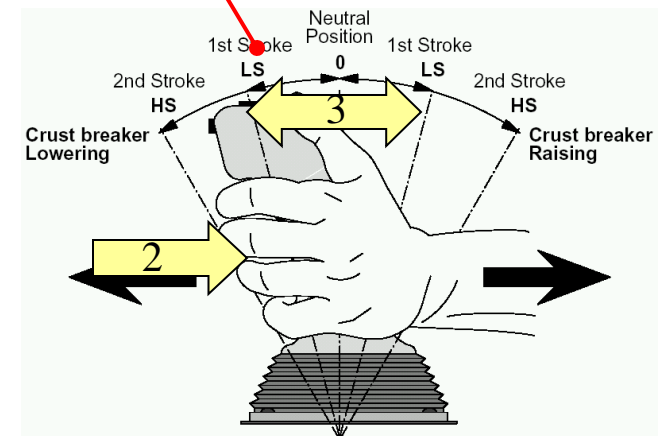


Adjust flow setting at 0,1V or 10V

Réglage de la carte de débit
Flow card adjustment

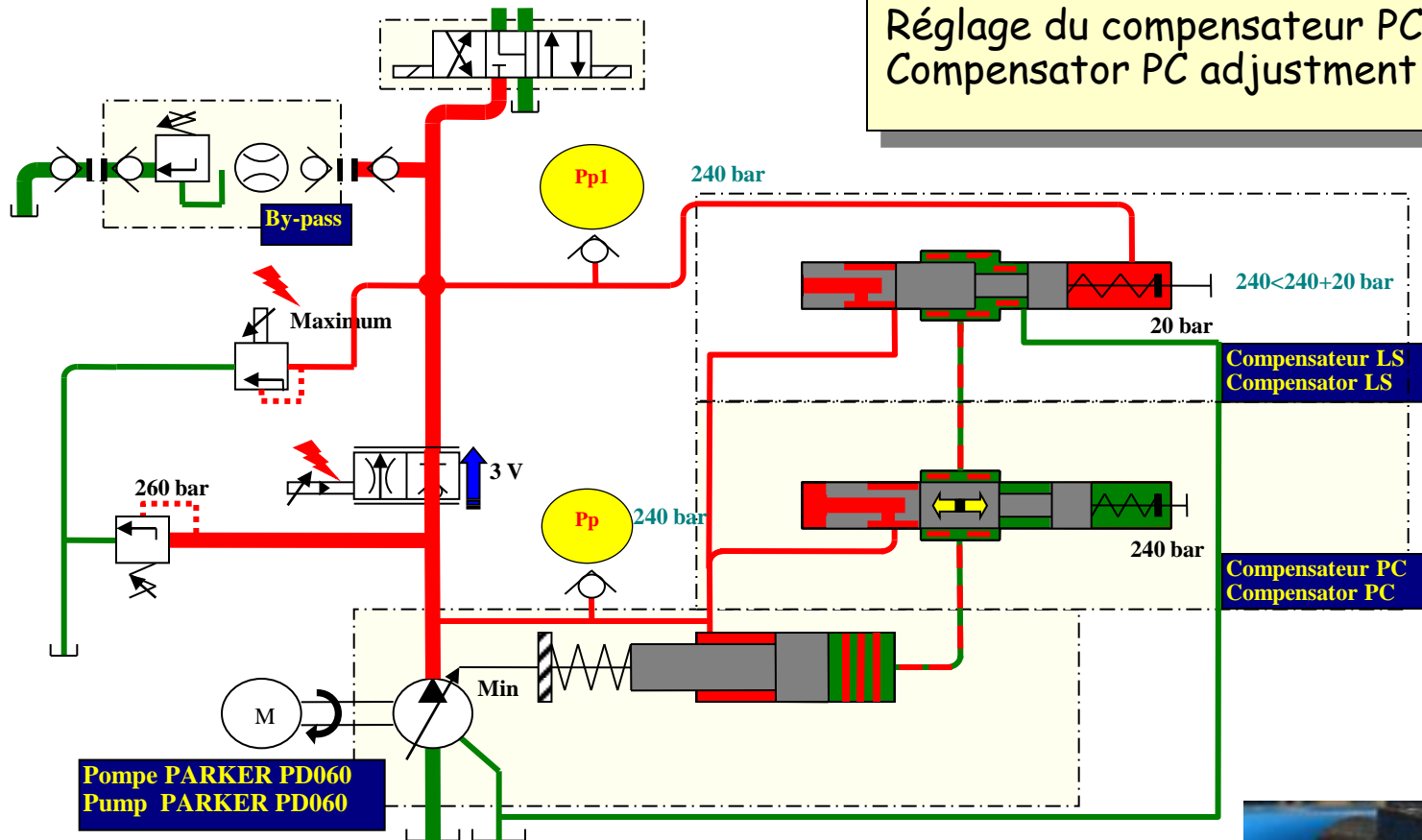


1 Mvt activated (5V in pressure)

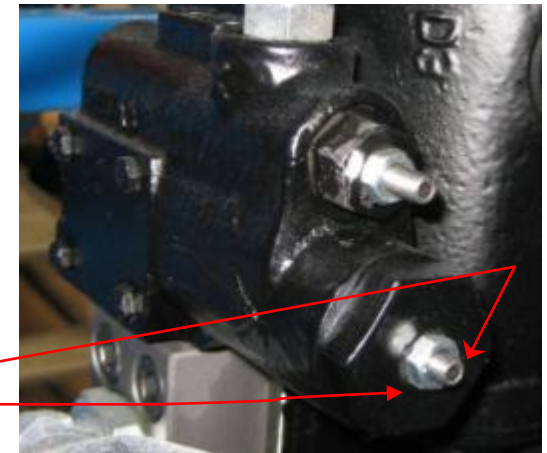


Select calibration view for Line 1 or Line 2

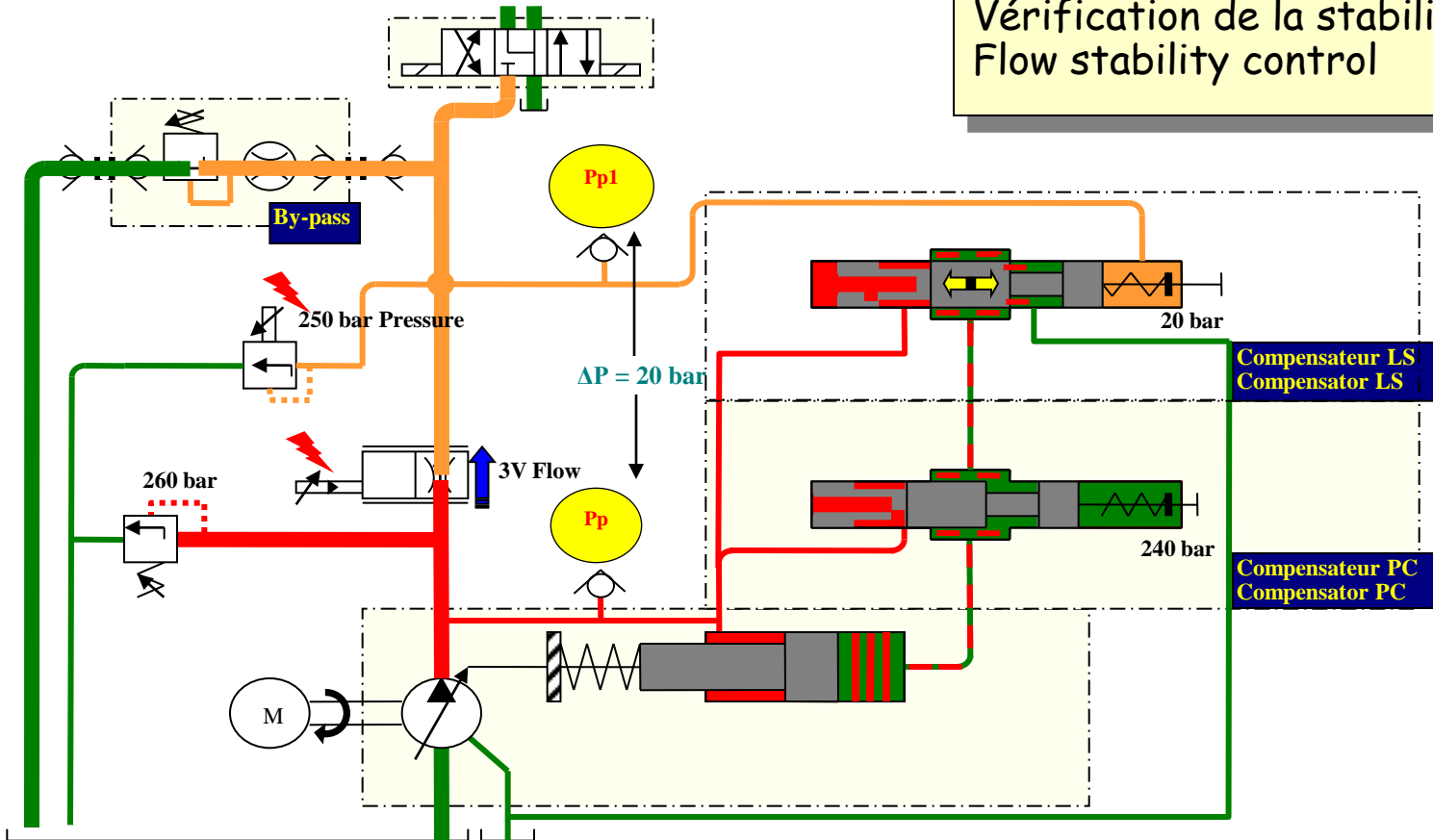
Réglage du compensateur PC Compensator PC adjustment



1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. Open fully pressure limiter on By-pass
3. 1 Mvt activated (adjust 10V in pressure & 3V in flow)
4. Tight fully pressure limiter on By-pass
5. Loosen the high pressure compensator (PC) until to reach 240 bar on Pp
6. Lock with nut



Vérification de la stabilité du débit Flow stability control



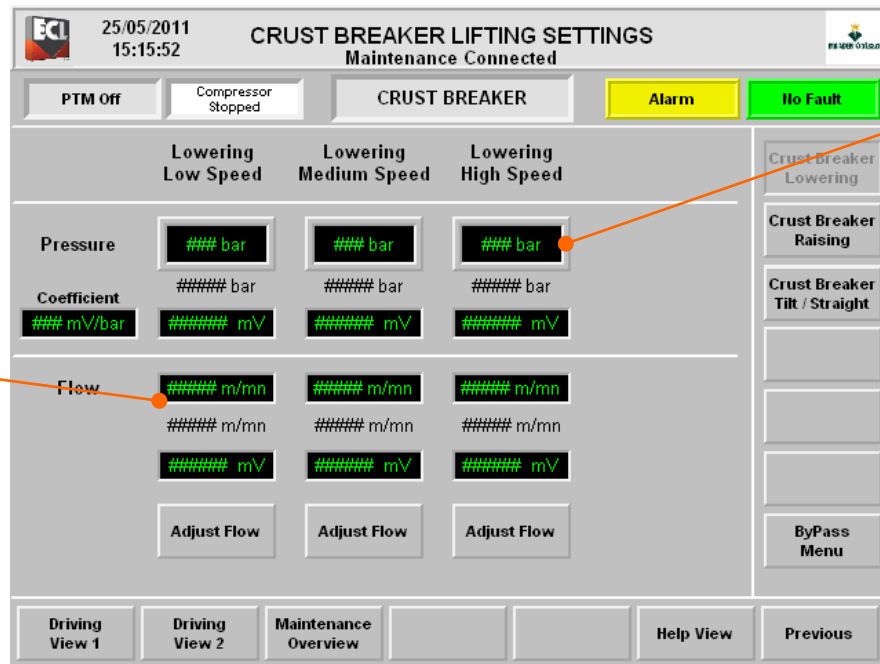
Starting motor

1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. Connect the by pass circuit
3. Open fully the relief valve of the by pass circuit
4. 1 Mvt activated
5. Adjust the pressure setting value to 10V on Panel view
6. Adjust the flow setting value to 3V on Panel view
7. Increase pressure with the relief Valve from 20 to 220 bar read on Pp1 or Pp2.
8. Control that flow value is stable (+- 2 l/min)
9. Control that the ΔP is stable (20 bar +- 2 bar)

MOVEMENT FLOW & PRESSURE SETTINGS

Step 2 = FLOW settings:

- The flow setting value must be adjust as per speed on the data sheet indicated in the maintenance manual.



Pressure setting value in bar

Step 1 = PRESSURE settings:

- The pressure setting value must be adjust as per the data sheet indicated in the maintenance manual.

Flow setting value in m/min

Step 3 = Calibration:

- Press 'Adjust flow' button on Panel View than press dead man on joystick => The tool will move in automatic to adjust the flow as per encoder value (in m/min).

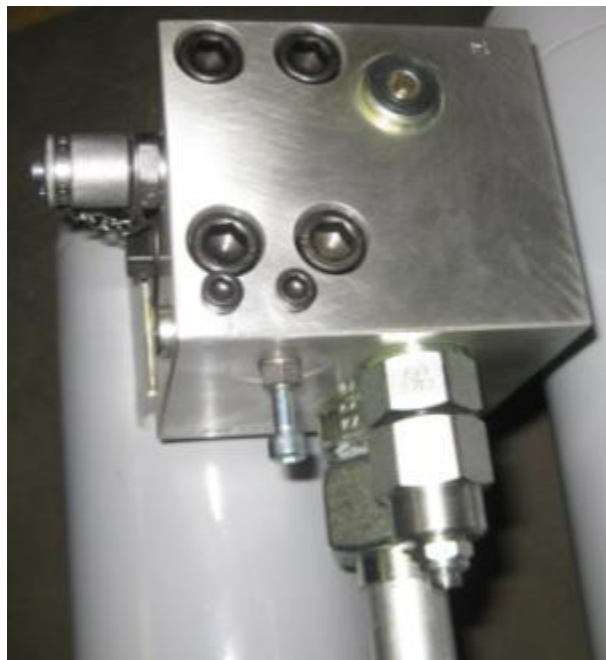


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EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

VALVES DE RETENUE **RETAINING VALVES**

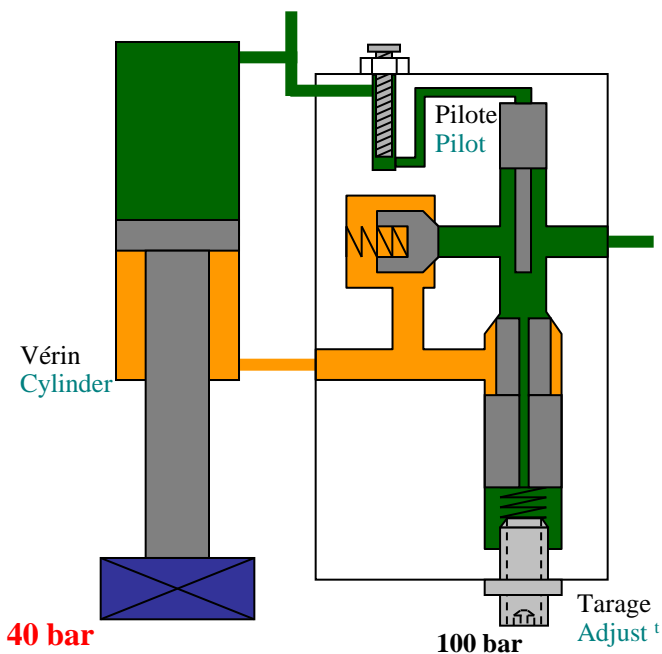
VALVE D'EQUILIBRAGE COUNTER BALANCE VALVE



Counterbalance valve SUN

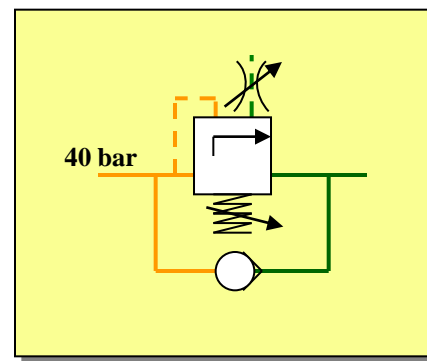
For adjustment, valve must be fully unscrew and tools with maximum load !
Down motion activated, start to screw CW valve until tools start moving down

VALVE D'EQUILIBRAGE COUNTER BALANCE VALVE



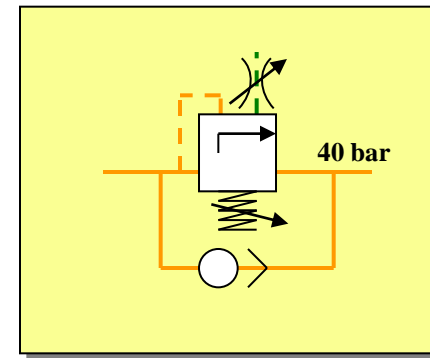
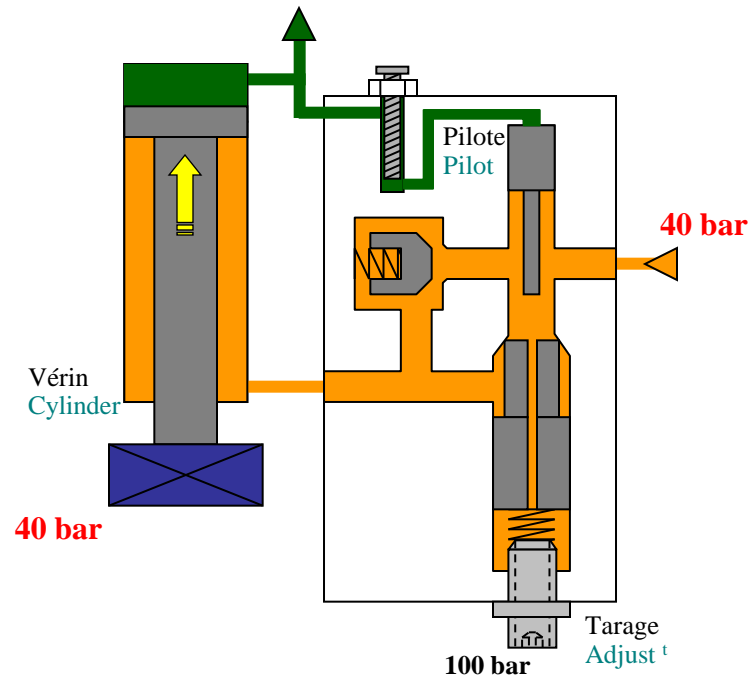
40 < 100 bar

Retenue - Holding



Caution : for the SUN valves, it is necessary to unscrew (CCW) to obtain the maximum pressure and to screw (CW) to decrease setting

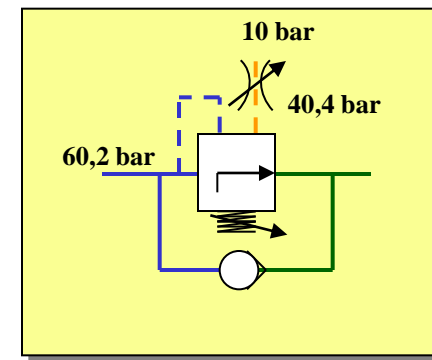
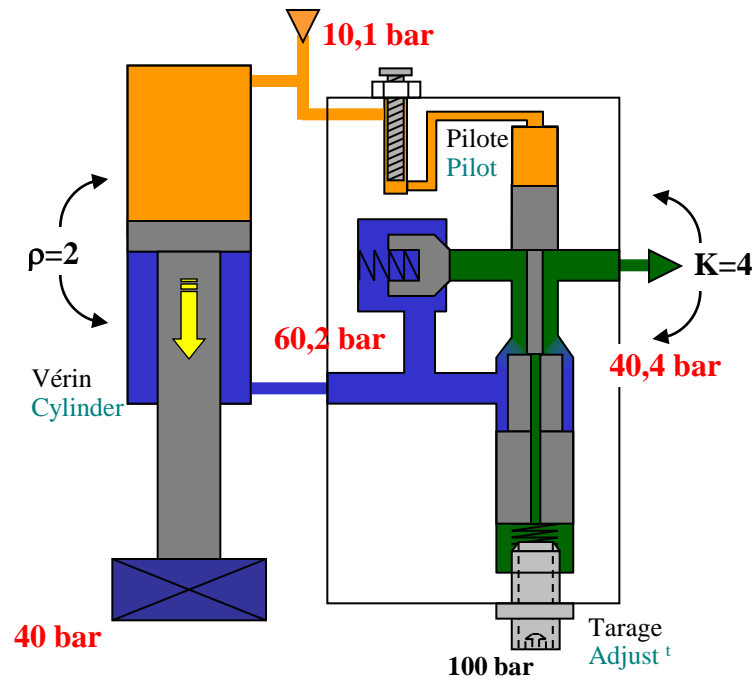
VALVE D'EQUILIBRAGE COUNTER BALANCE VALVE



40 = 40 bar

Montée - Up

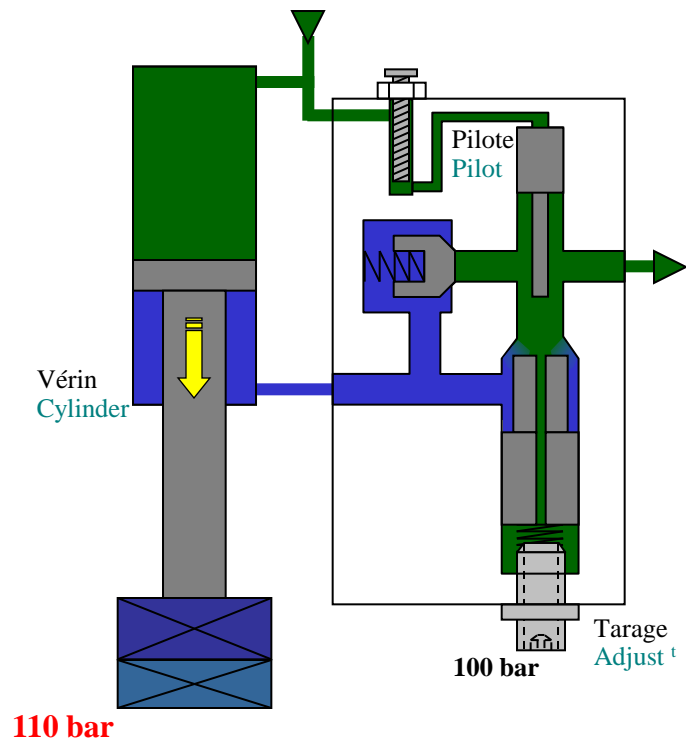
VALVE D'EQUILIBRAGE COUNTER BALANCE VALVE



100,6 > 100 bar

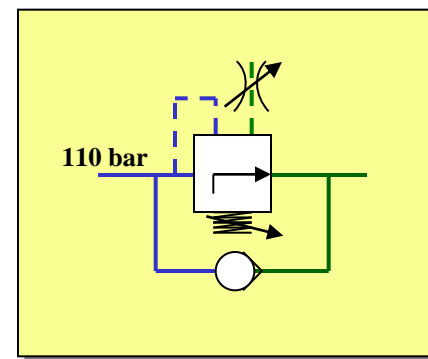
Descente - Down

VALVE D'EQUILIBRAGE COUNTER BALANCE VALVE

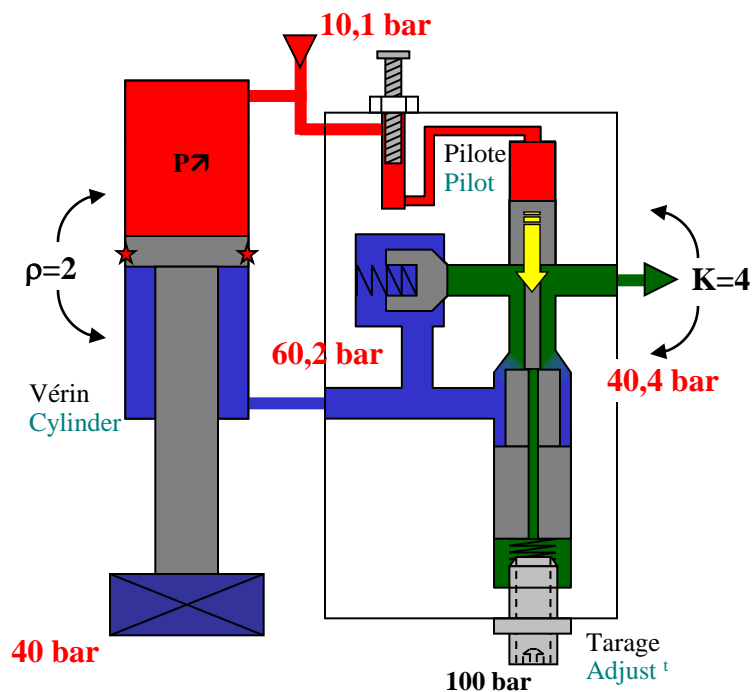


110 > 100 bar

Surcharge - Overload

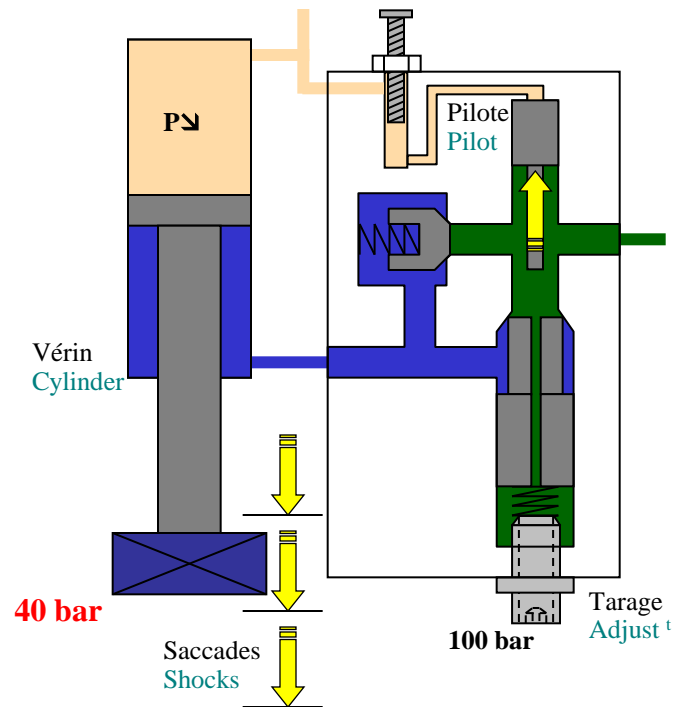


VALVE D'EQUILIBRAGE COUNTER BALANCE VALVE



100,6 > 100 bar

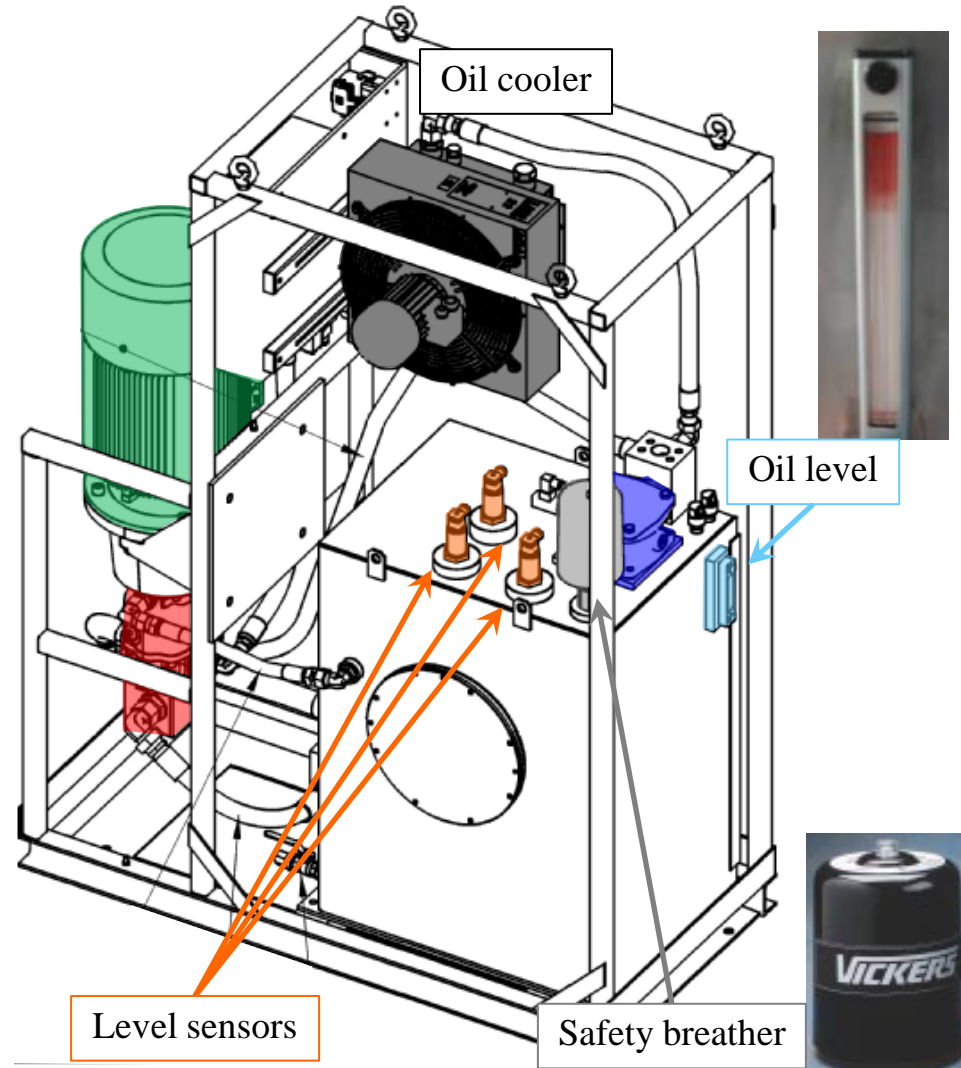
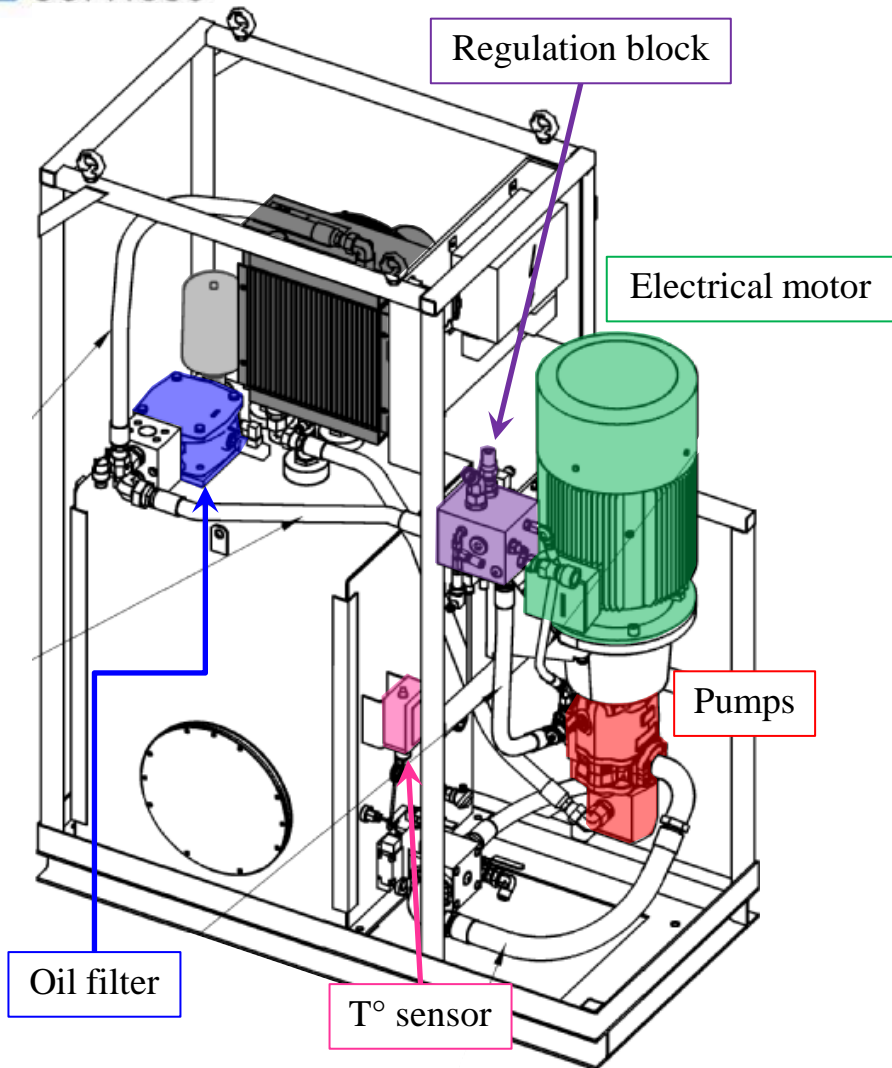
Descente - Down



Solution: resserrer la vis d'amortissement (T° huile 60°C)
Solution: tight the dampening screw (oil T° 60°C)

Problème d'un mauvais ajustement de l'amortissement /
Trouble when the dampening adjustment is not correct

HYDRAULIC UNIT FRONT VIEW





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EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

**THANK YOU FOR YOUR
ATTENTION**

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MA'ADEN PROJECT

P1034 - PTM

POT TENDING MACHINE

Hydraulic diagram



Clamps locking device

Tightening:

Distributor (a) is energized.

Pressure: 90 bar

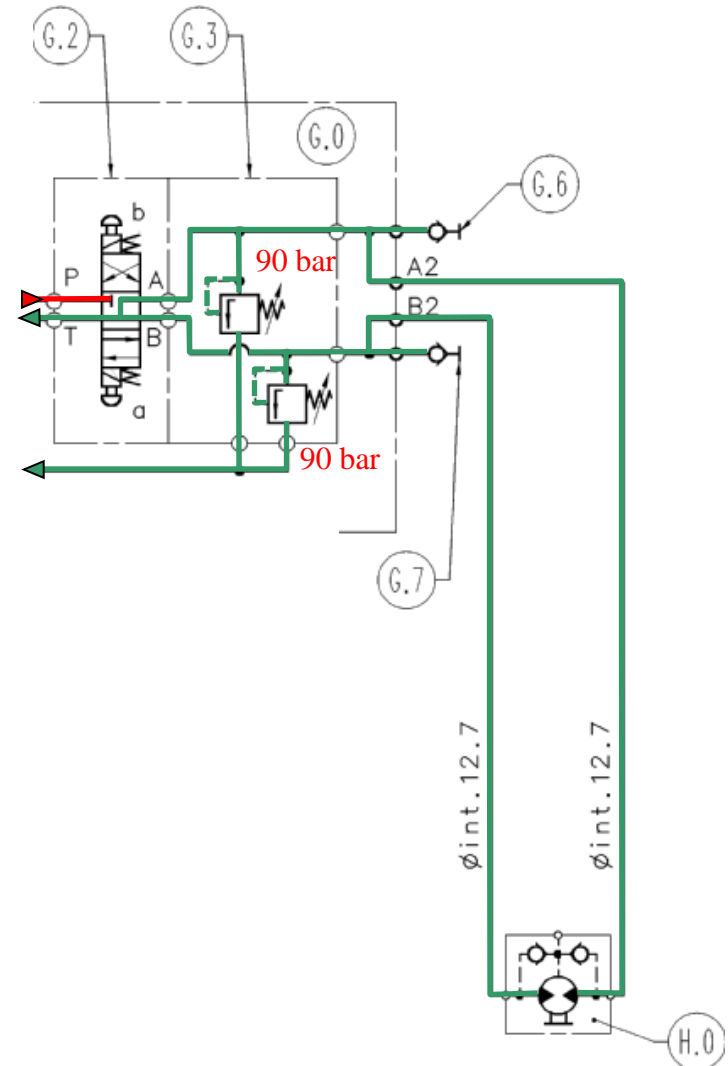
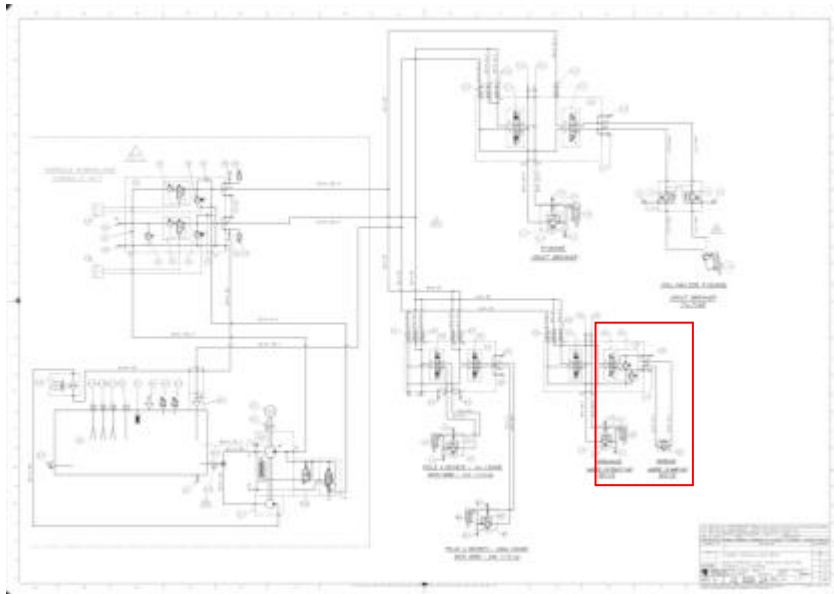
Flow: 24 l/mn

Loosening:

Distributor (b) is energized.

Pressure: 90 bar

Flow: 24 l/mn



Clamps locking device

Tightening:

Distributor (a) is energized.

Pressure: 90 bar

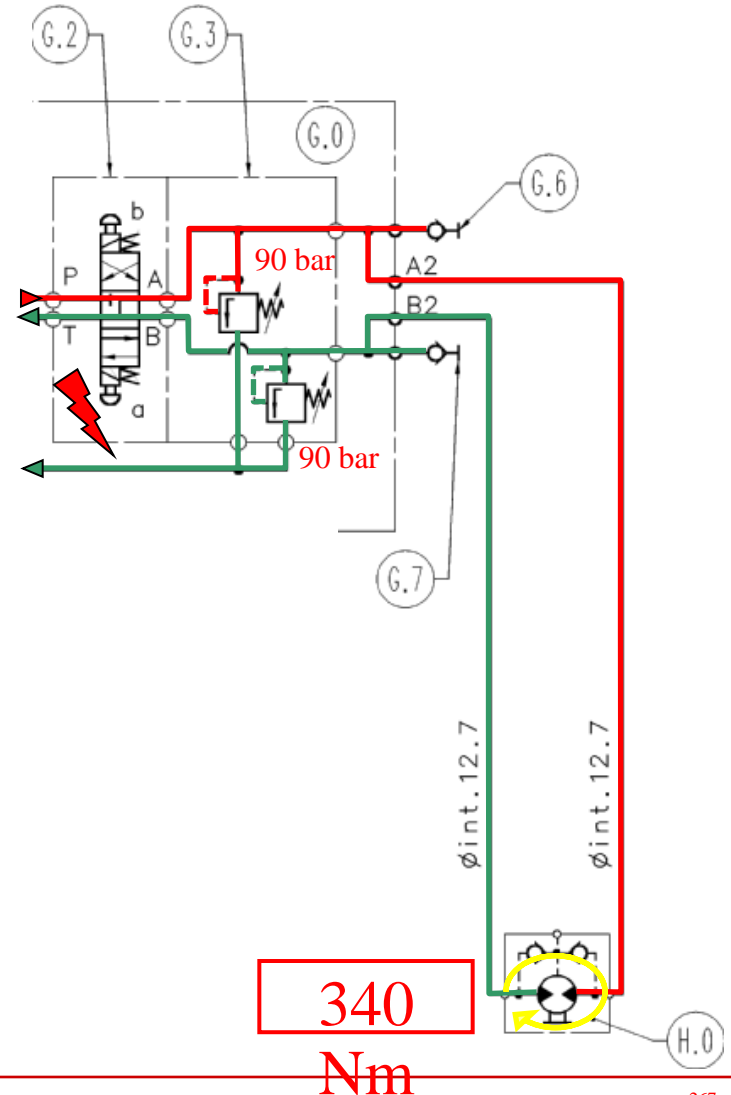
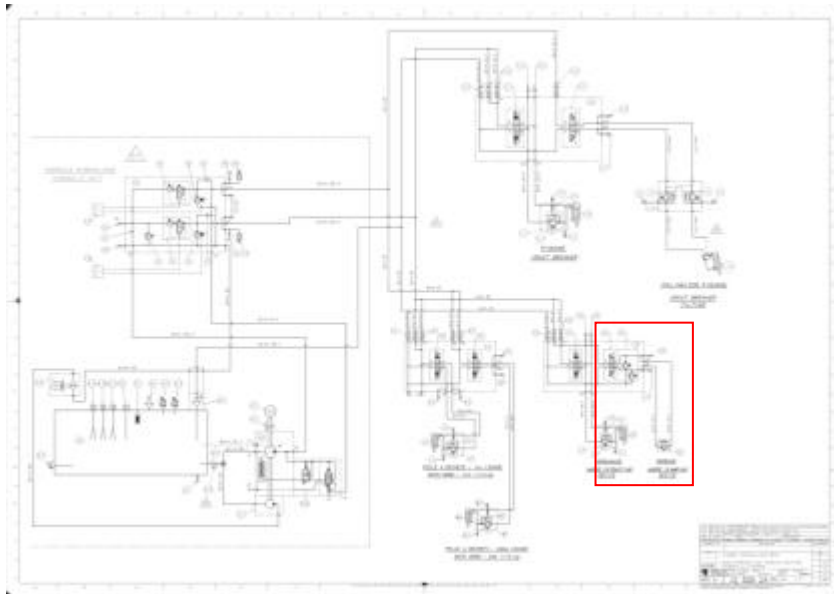
Flow: 24 l/mn

Loosening:

Distributor (b) is energized.

Pressure: 90 bar

Flow: 24 l/mn



Clamps locking device

Tightening:

Distributor (a) is energized.

Pressure: 90 bar

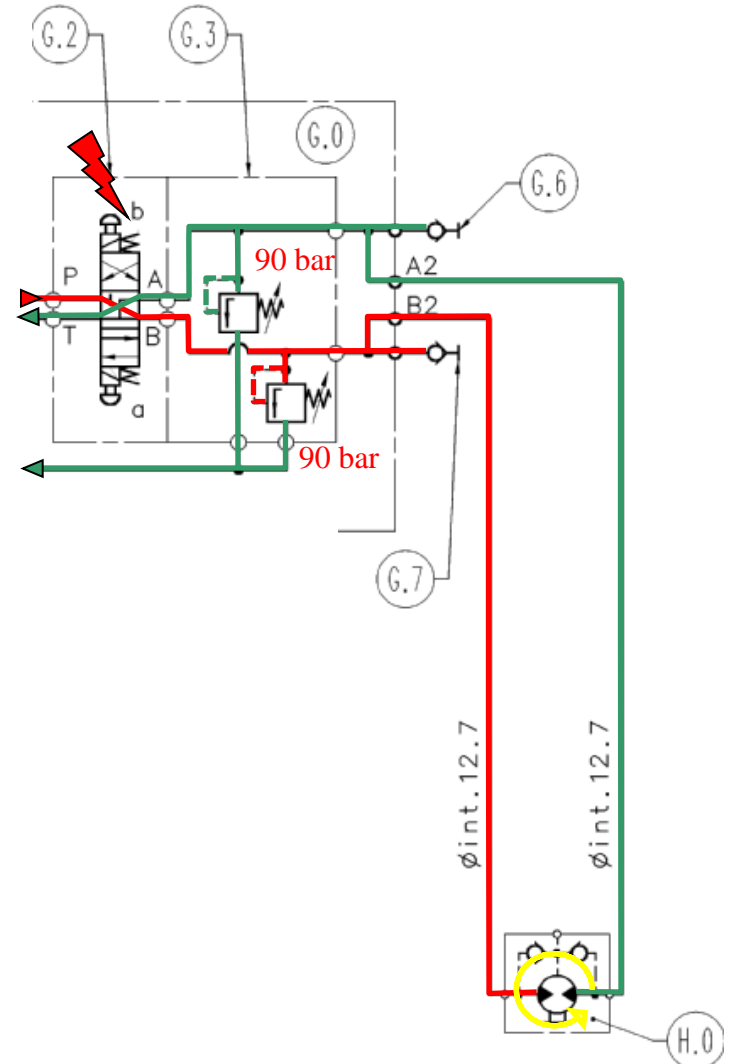
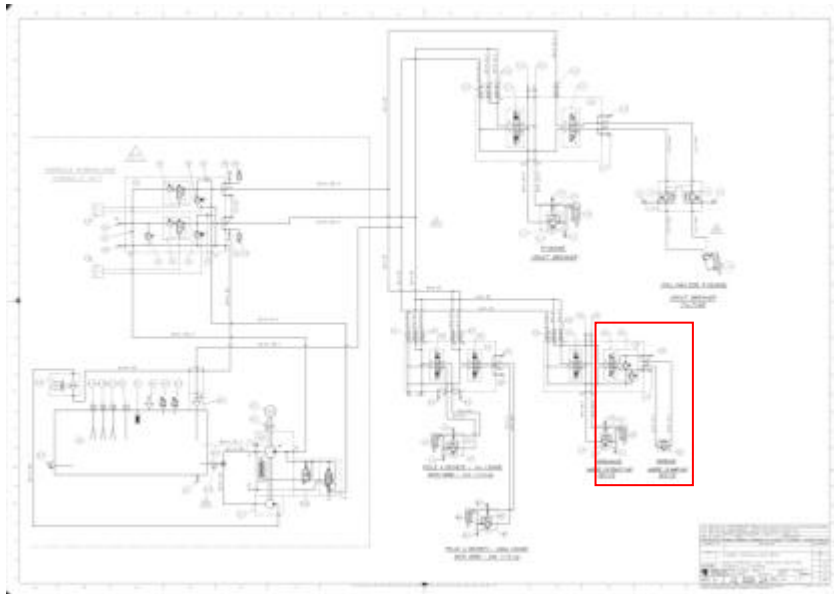
Flow: 24 l/mn

Loosening:

Distributor (b) is energized.

Pressure: 90 bar

Flow: 24 l/mn



Anode extracting assembly

Analogic sensor C.13

Retracting of the rod:

Distributor (b) is energized.

Pressure: 130 bar

Flow: 65 l/mn in HS (12 m/mn)

Flow: 8 l/mn in LS (1.5 m/mn)

In tension (Signal at 40 bar)

Pressure F Reduced: 40 bar

Flow: 8 l/mn

Extraction (At 130 bar)

Pressure F = 11t: 220 bar

Flow: 8 l/mn (1.5 m/mn)

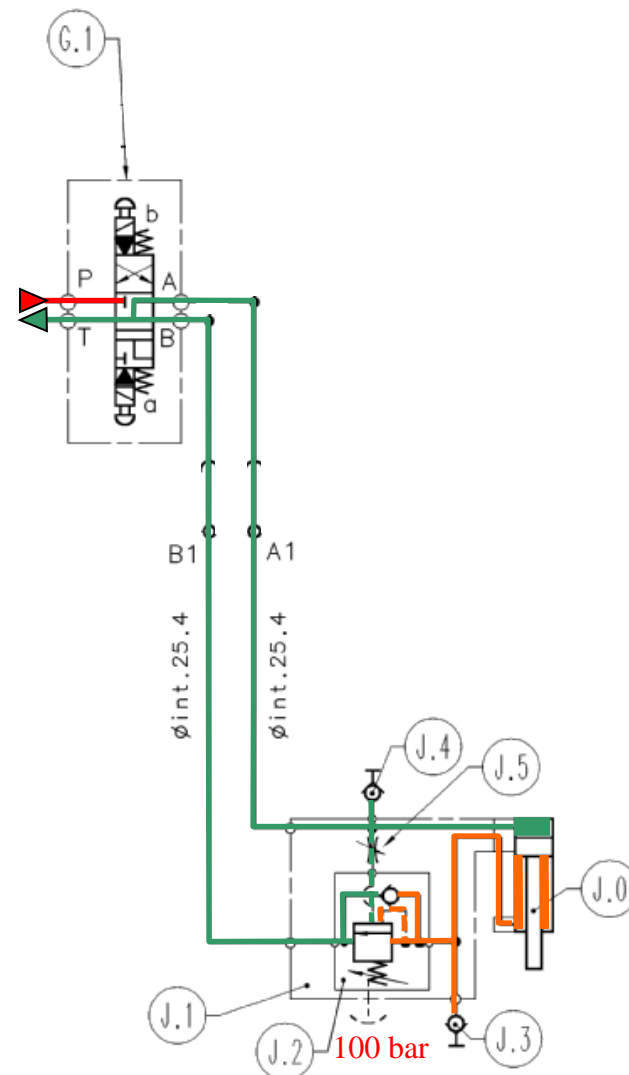
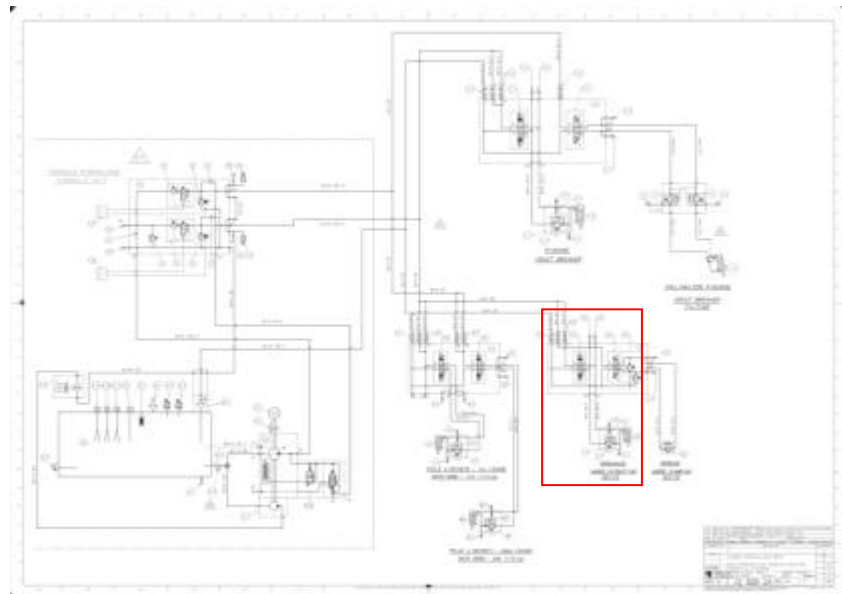
Extending of the rod:

Distributor (a) is energized. (Regeneration inside the distributor)

Pressure: 40 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.6 m/mn)



Anode extracting assembly

Analogic sensor C.13

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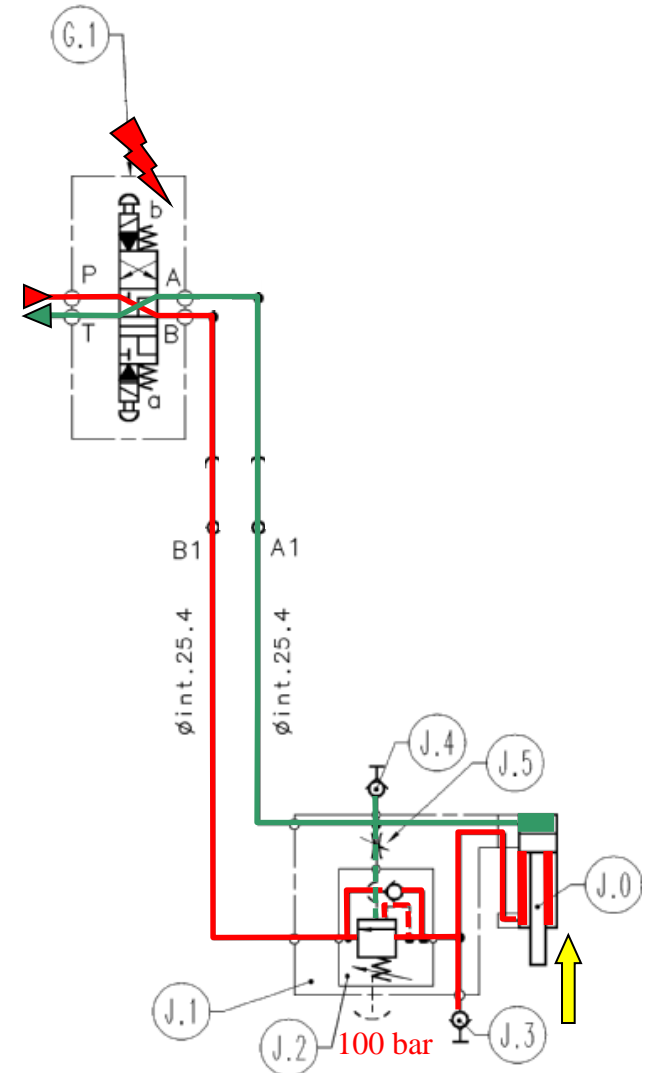
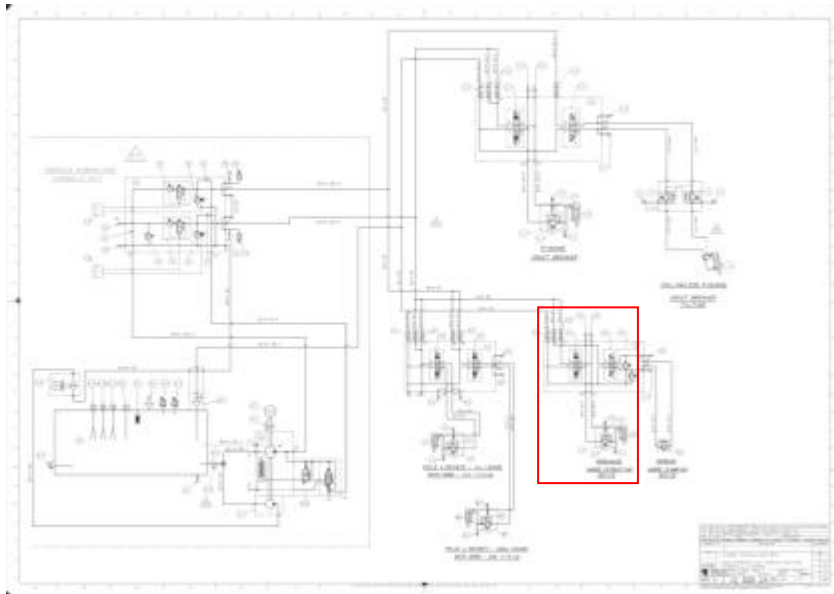
Extending of the rod:

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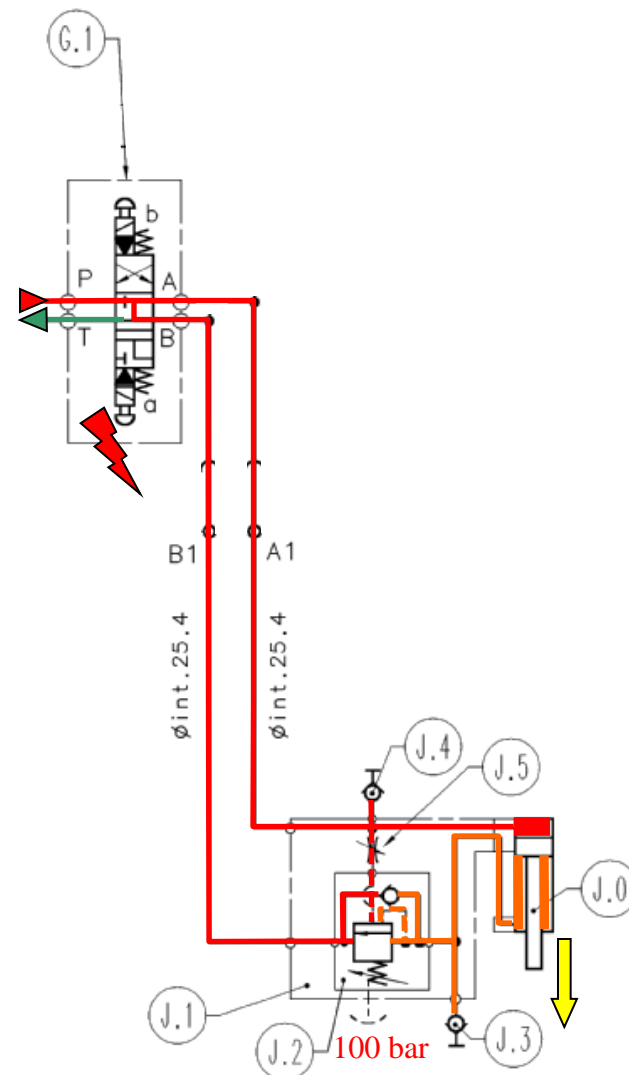
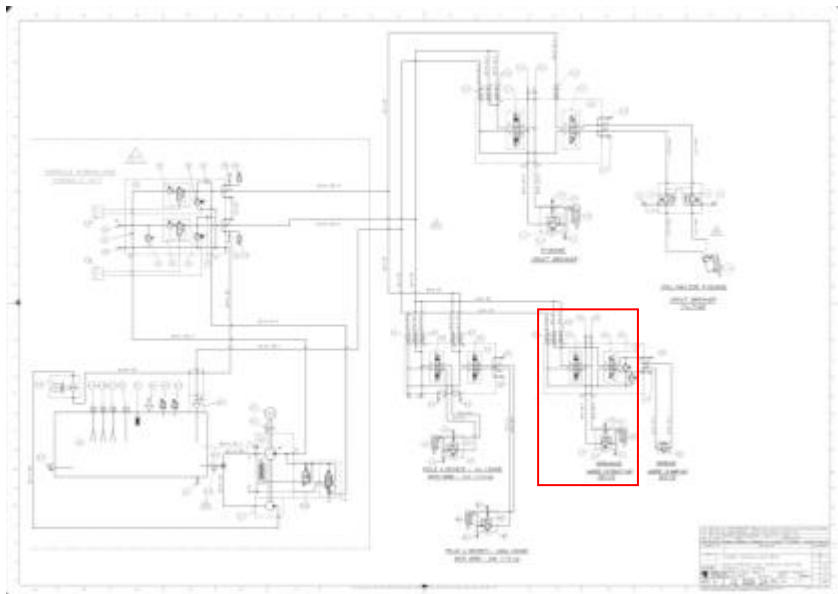
Extending of the rod:

Distributor (a) is energized. (Regeneration inside the distributor)

Pressure: 40 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.6 m/mn)



Crust breaker lifting

Retracting of the rod:

Distributor (b) is energized.

Pressure: 150 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Extending of the rod:

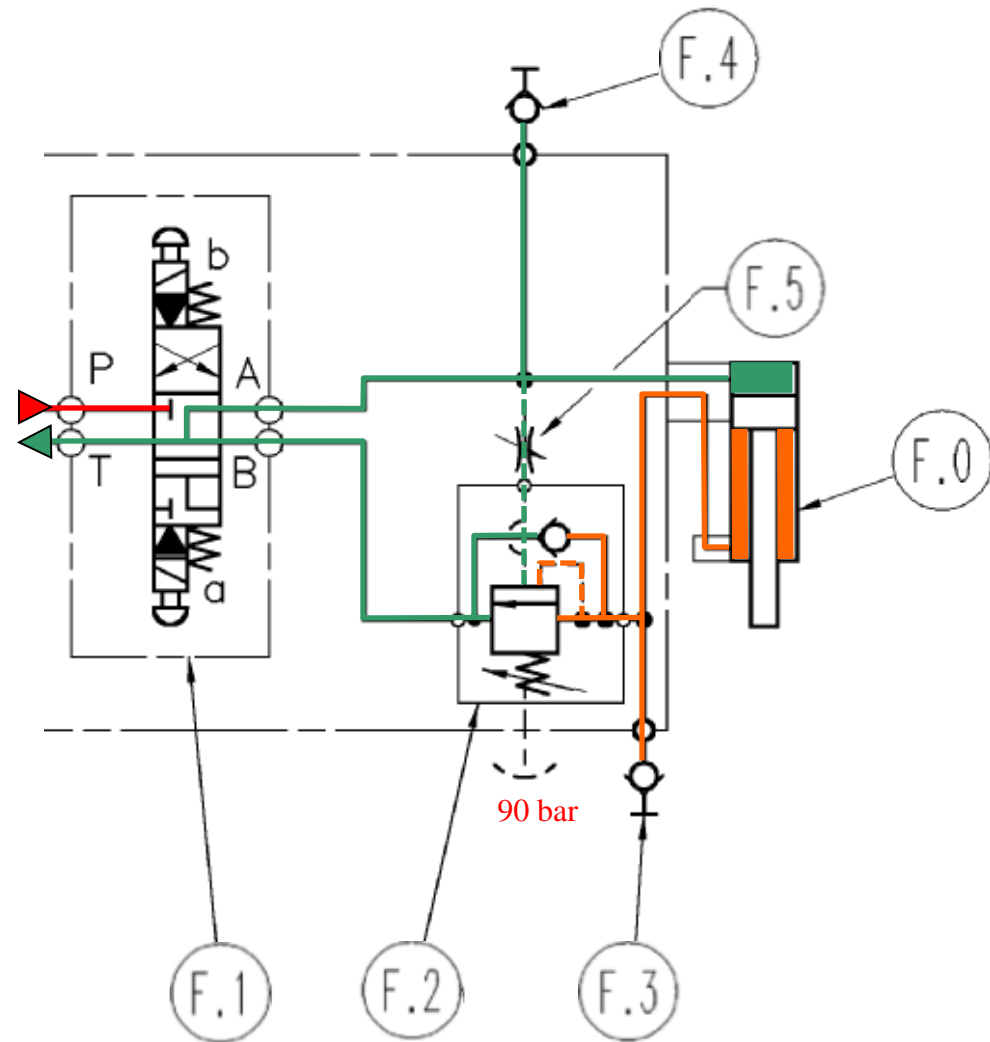
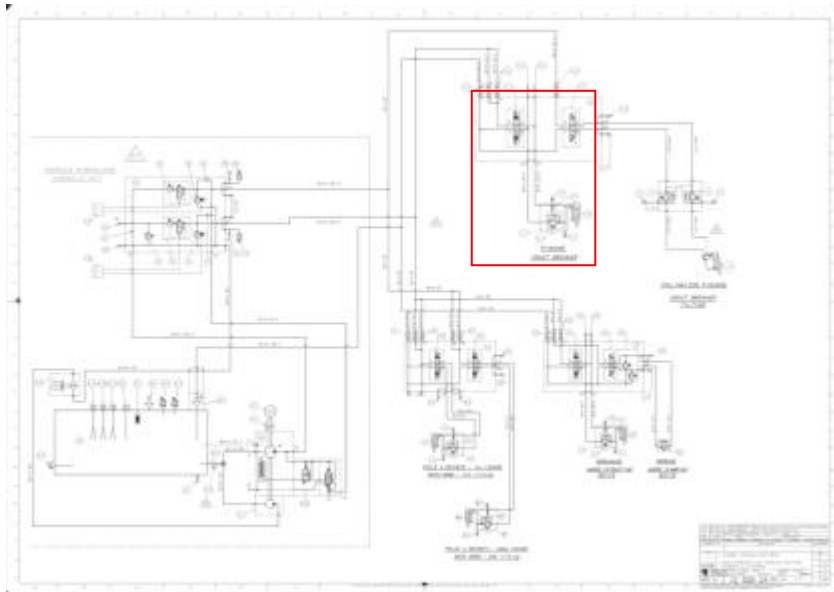
Distributor (a) is energized.

Regeneration

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)



Crust breaker lifting

Retracting of the rod:

Distributor (b) is energized.

Pressure: 150 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Extending of the rod:

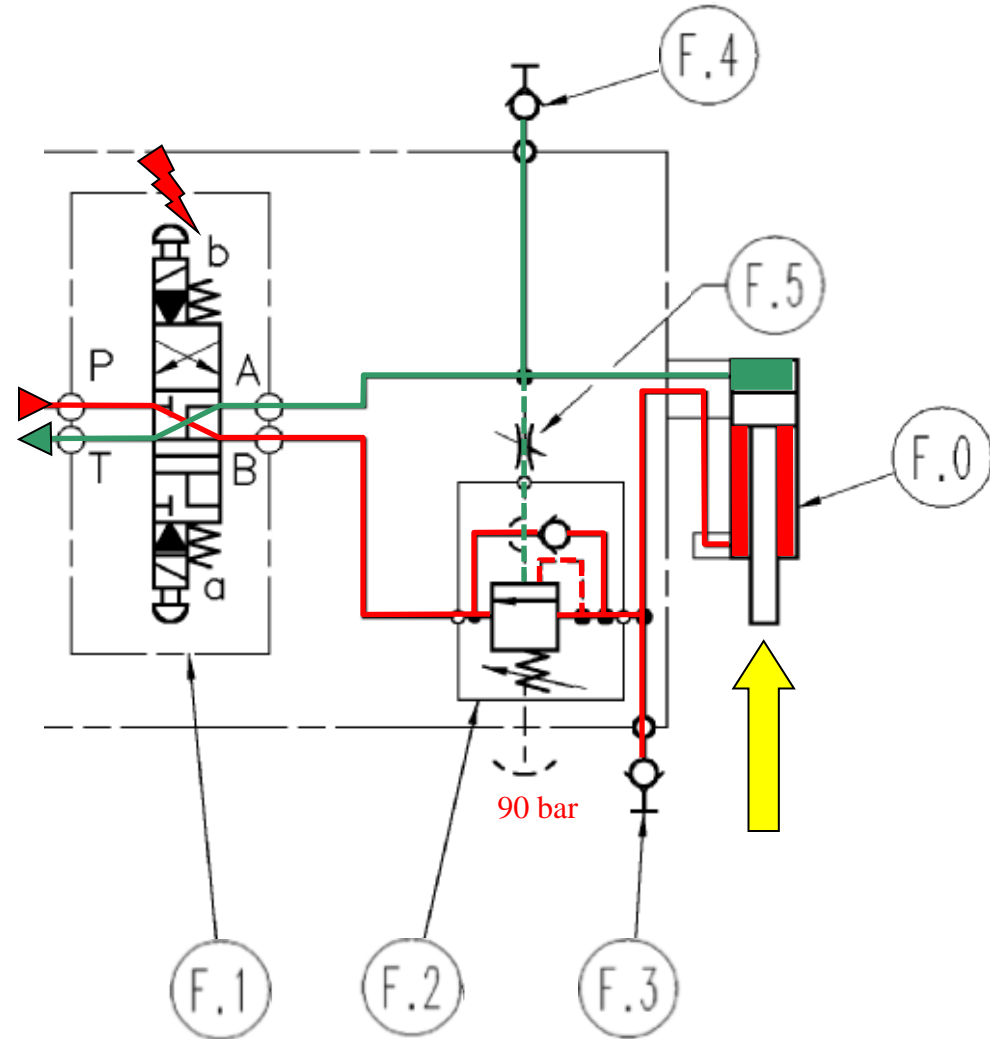
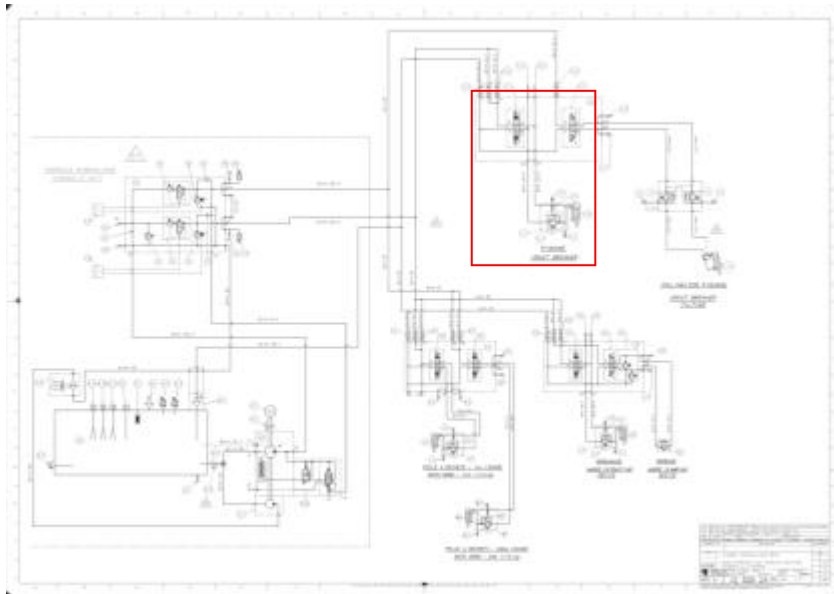
Distributor (a) is energized.

Regeneration

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)



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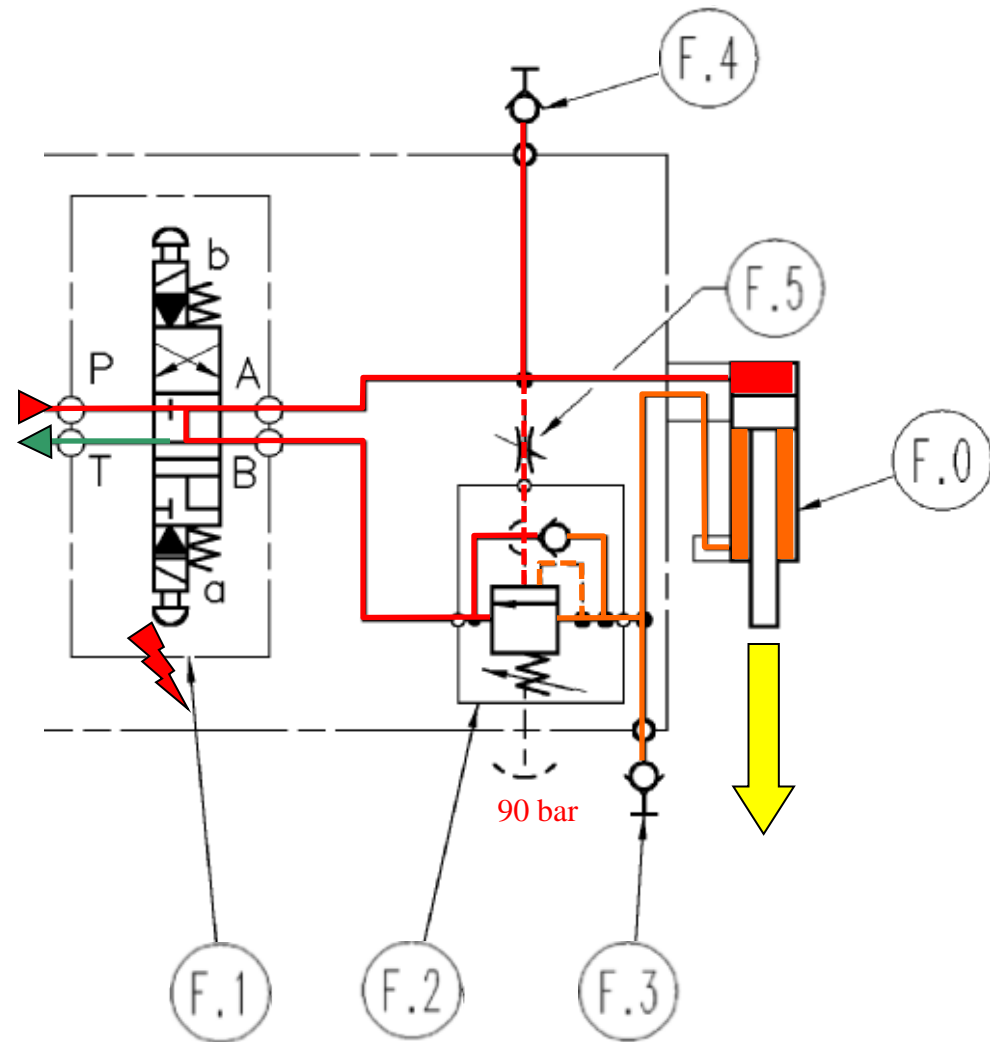
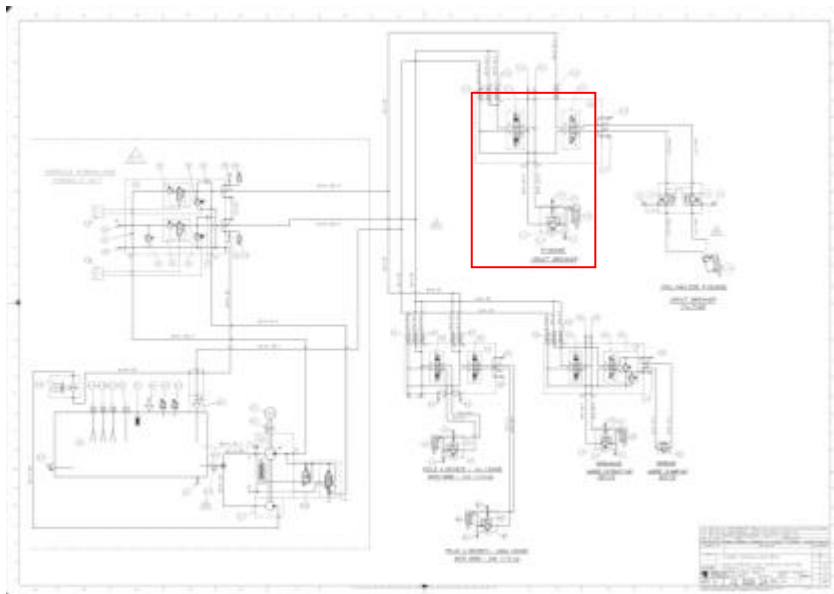
Distributor (a) is energized.

Regeneration

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)



Crust breaker tilting

Retracting of the rod (tilting):

Distributor (b) is energized.

Pressure: 60 bar

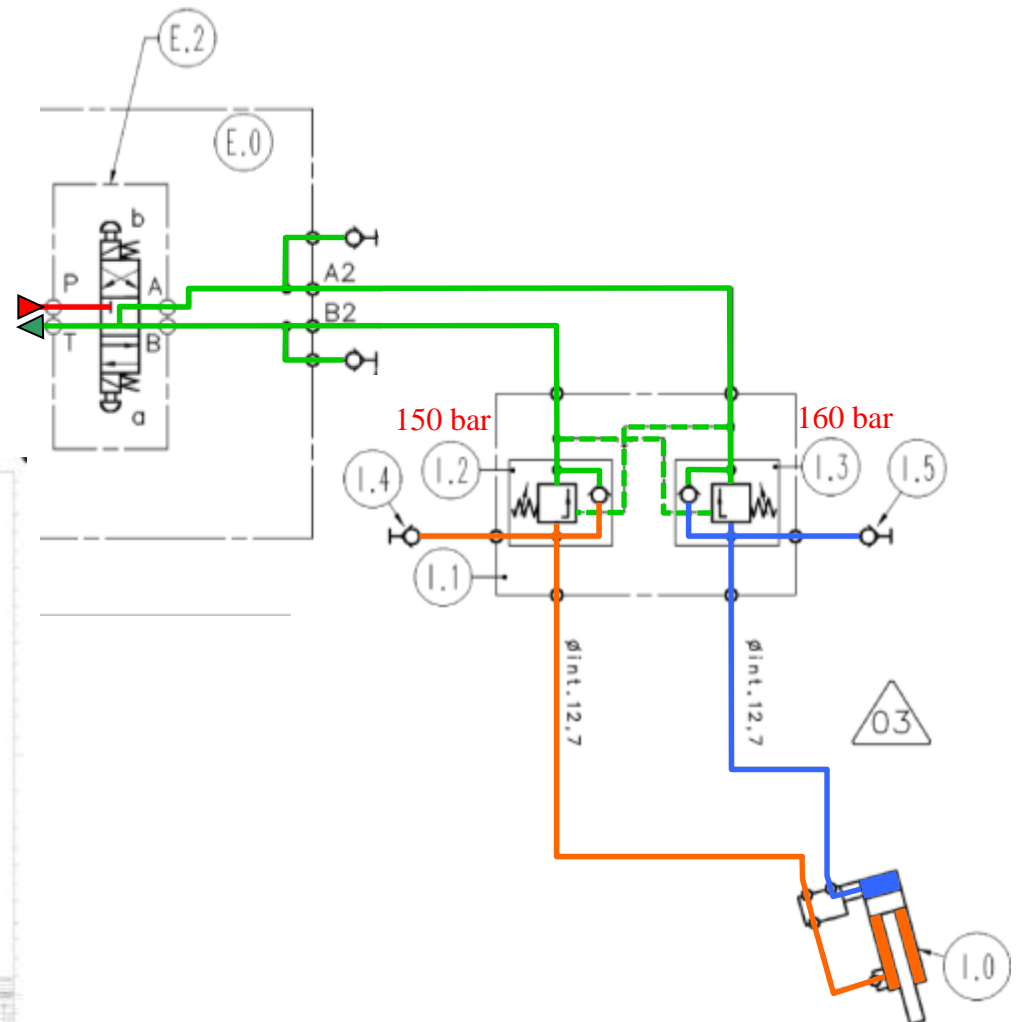
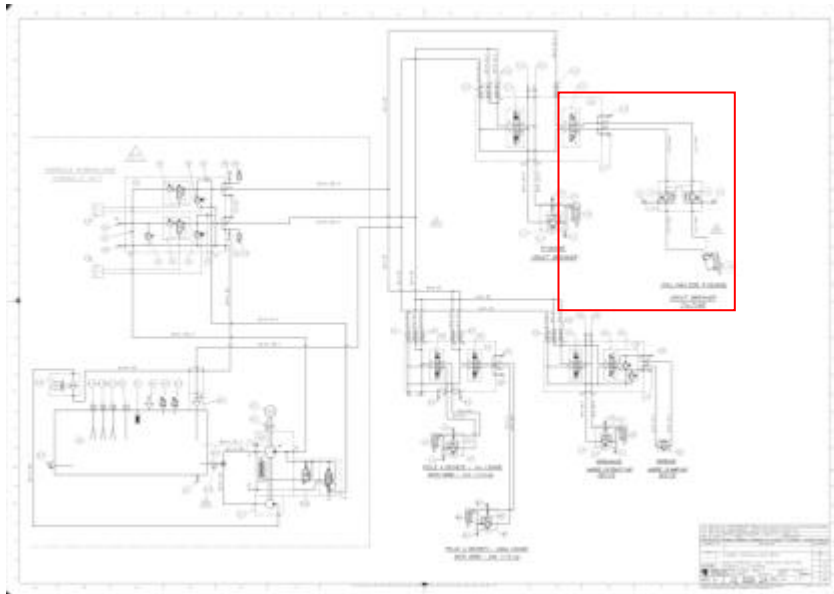
Flow: 12 l/mn in HS (4.8 m/mn)

Extending of the rod:

Distributor (a) is energized.

Pressure: 120 bar

Flow: 13 l/mn in HS (5 m/mn)



Crust breaker tilting

Retracting of the rod (tilting):

Distributor (b) is energized.

Pressure: 60 bar

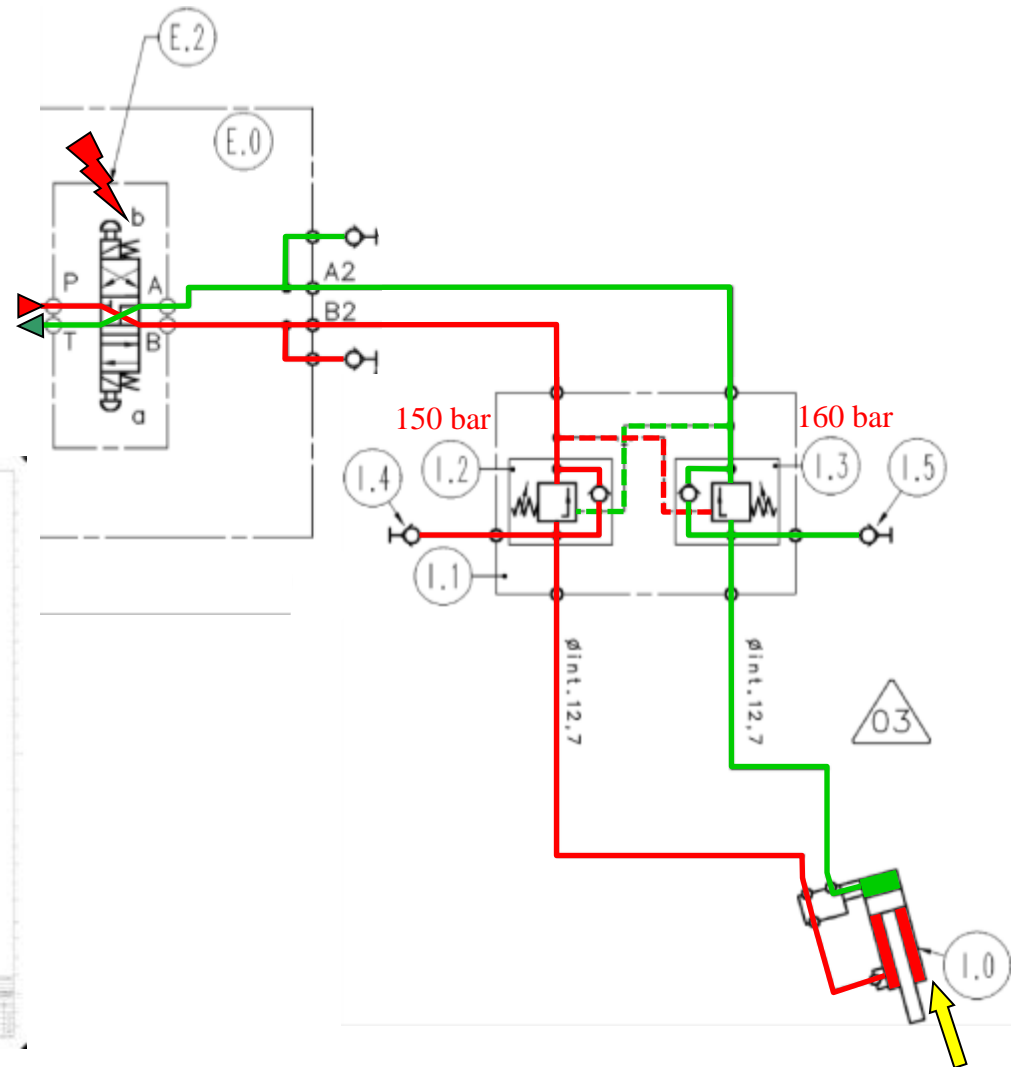
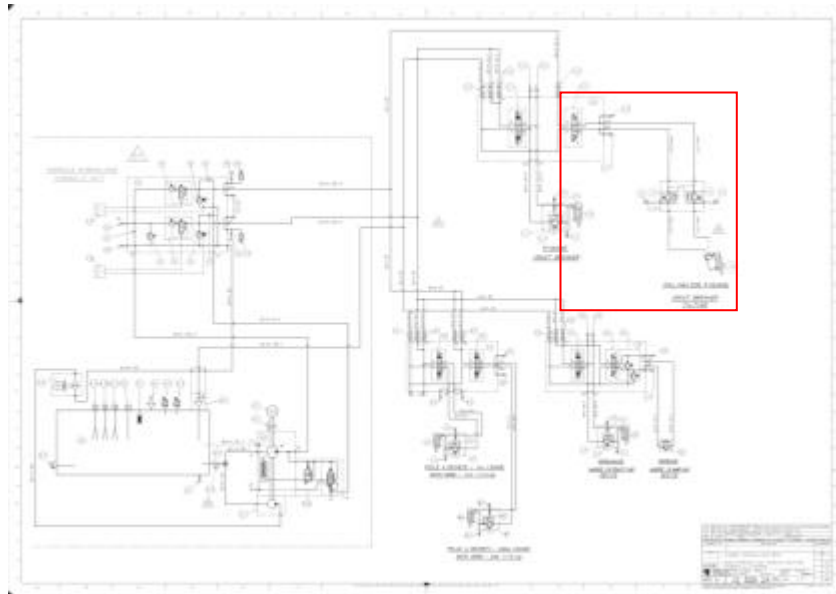
Flow: 12 l/mn in HS (4.8 m/mn)

Extending of the rod:

Distributor (a) is energized.

Pressure: 120 bar

Flow: 13 l/mn in HS (5 m/mn)



Crust breaker tilting

Retracting of the rod (tilting):

Distributor (b) is energized.

Pressure: 60 bar

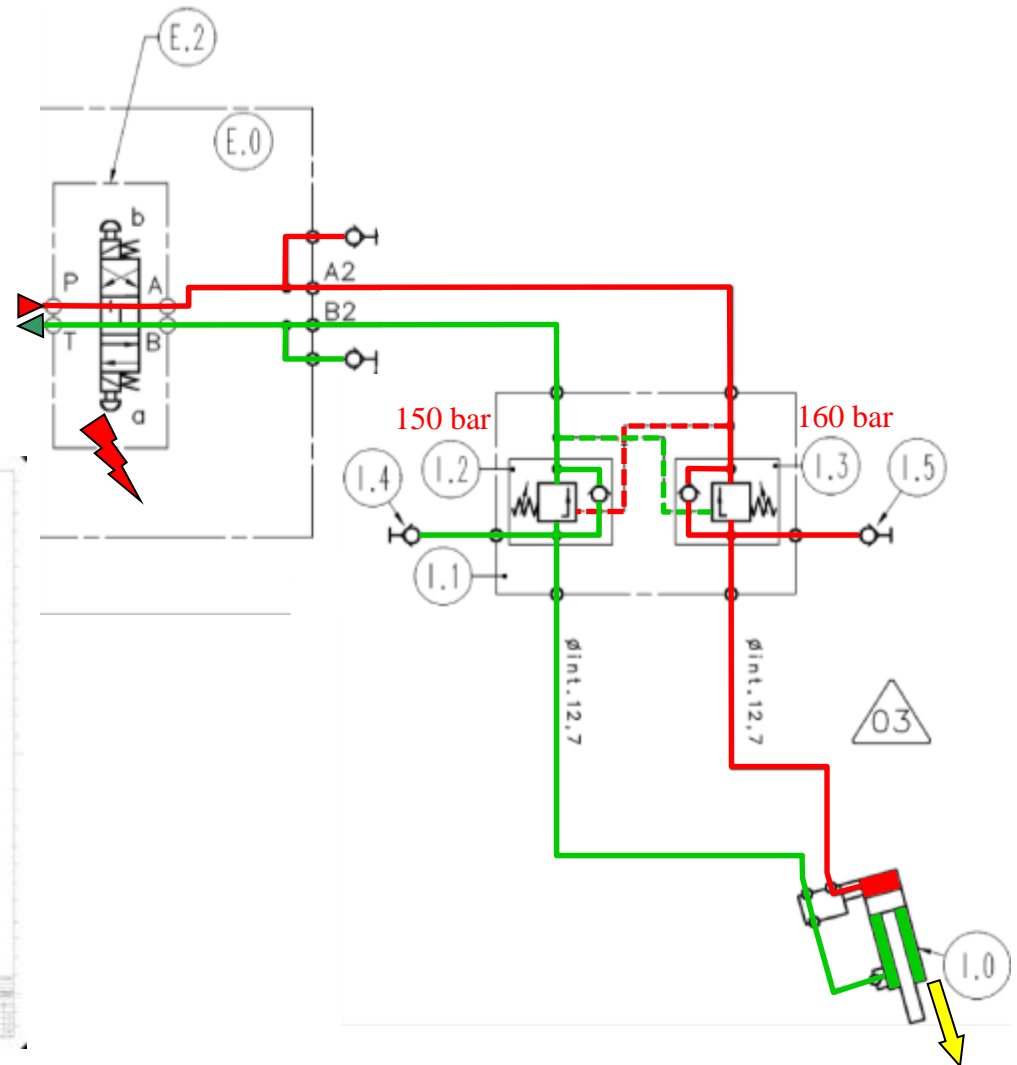
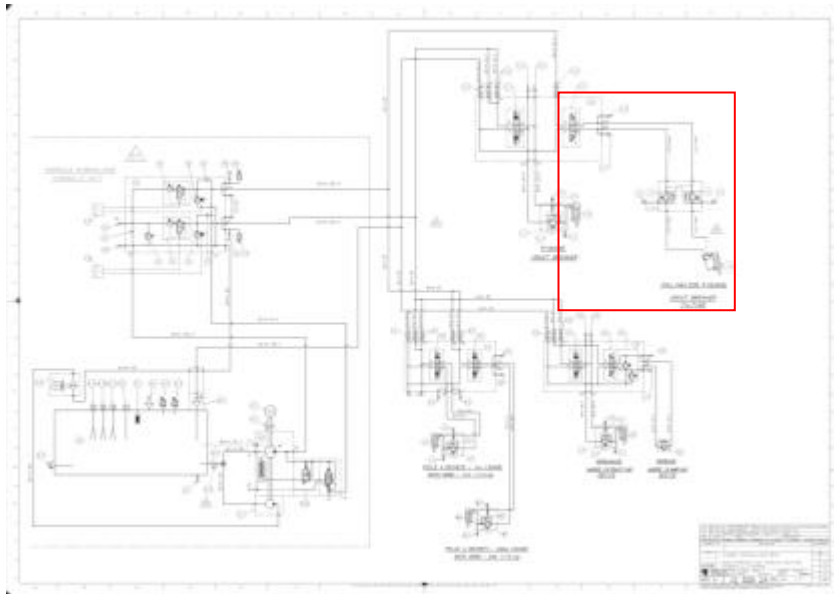
Flow: 12 l/mn in HS (4.8 m/mn)

Extending of the rod:

Distributor (a) is energized.

Pressure: 120 bar

Flow: 13 l/mn in HS (5 m/mn)



Cleaning shovel 1st cylinder

Retracting of the rod:

Distributor (b) is energized.

Pressure: 220 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Analogic
sensor C.13

Extending of the rod: (Signal at 30 bar)

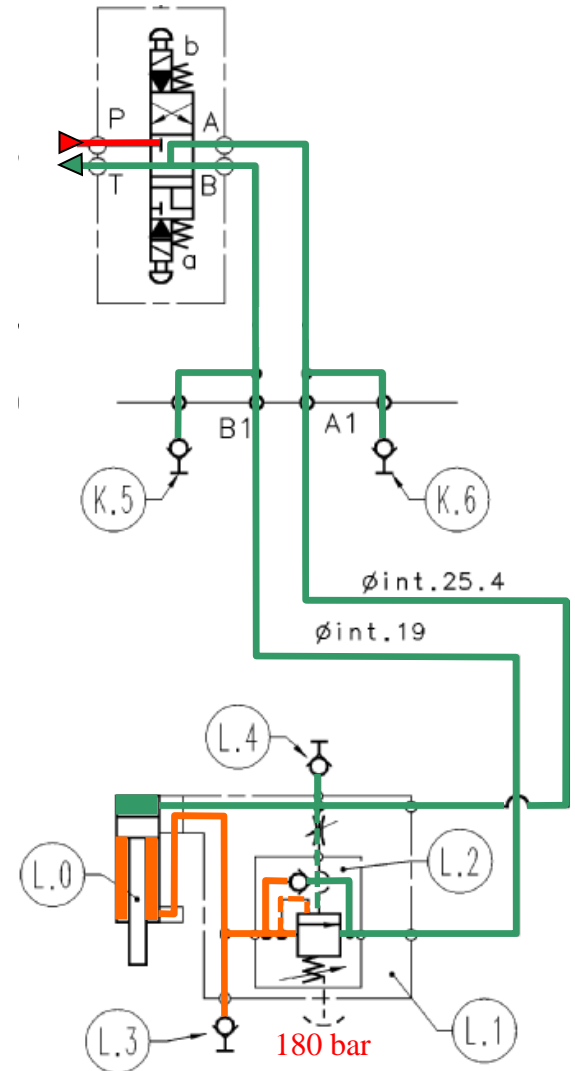
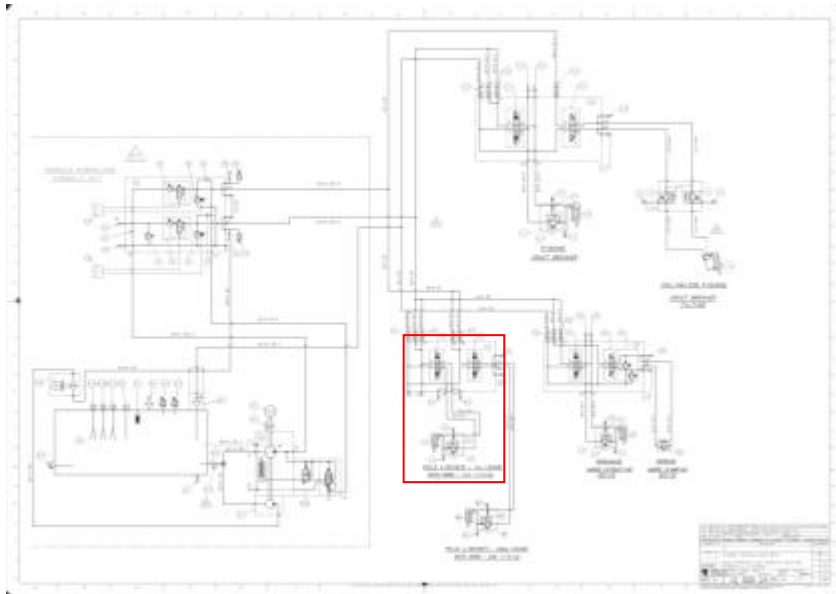
Distributor (a) is energized.

Regeneration in the distributor

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)



Cleaning shovel 1st cylinder

Retracting of the rod:

Distributor (b) is energized.

Pressure: 220 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Extending of the rod: (Signal at 30 bar)

Distributor (a) is energized.

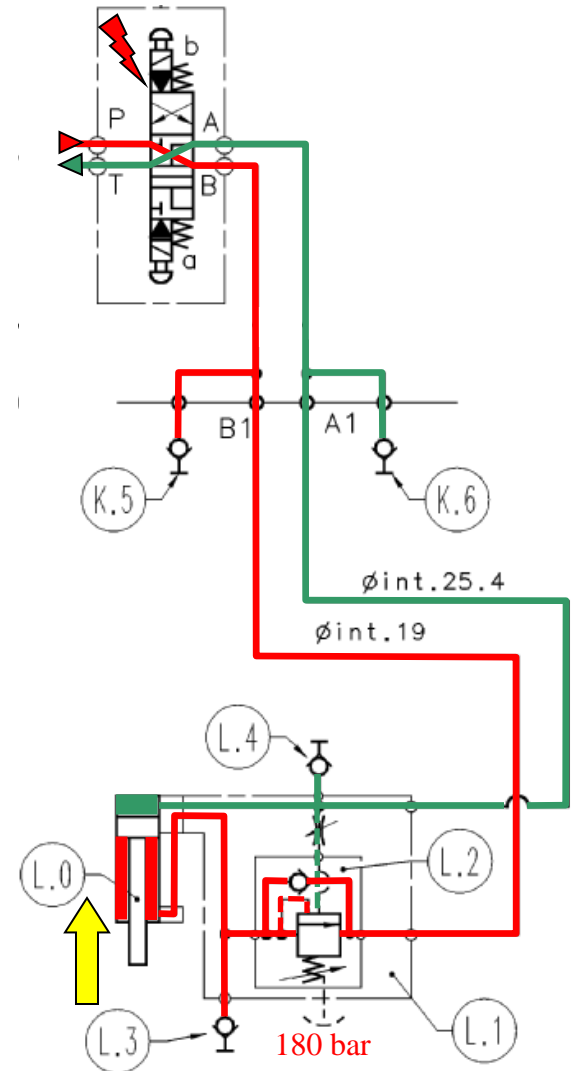
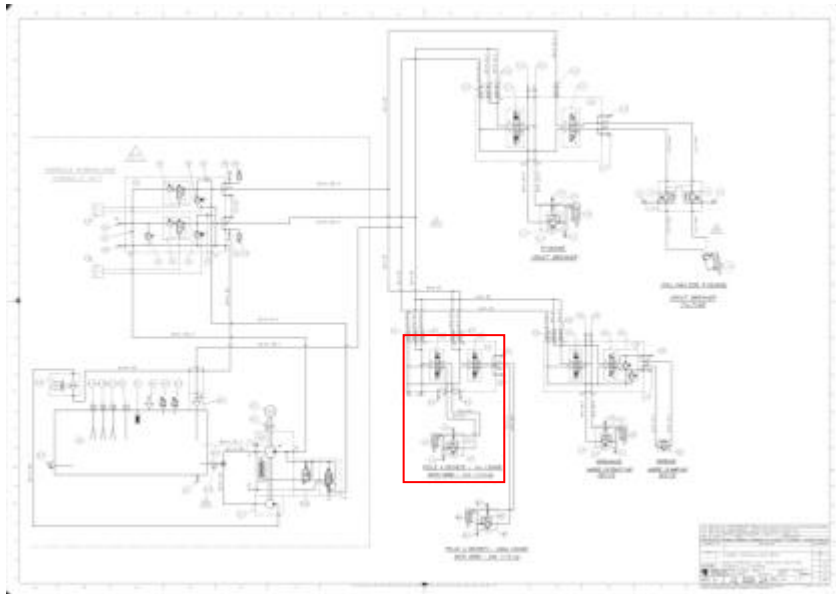
Regeneration in the distributor

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Analogic
sensor C.13



Cleaning shovel 1st cylinder

Retracting of the rod:

Distributor (b) is energized.

Pressure: 220 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Analogic
sensor C.13

Extending of the rod: (Signal at 30 bar)

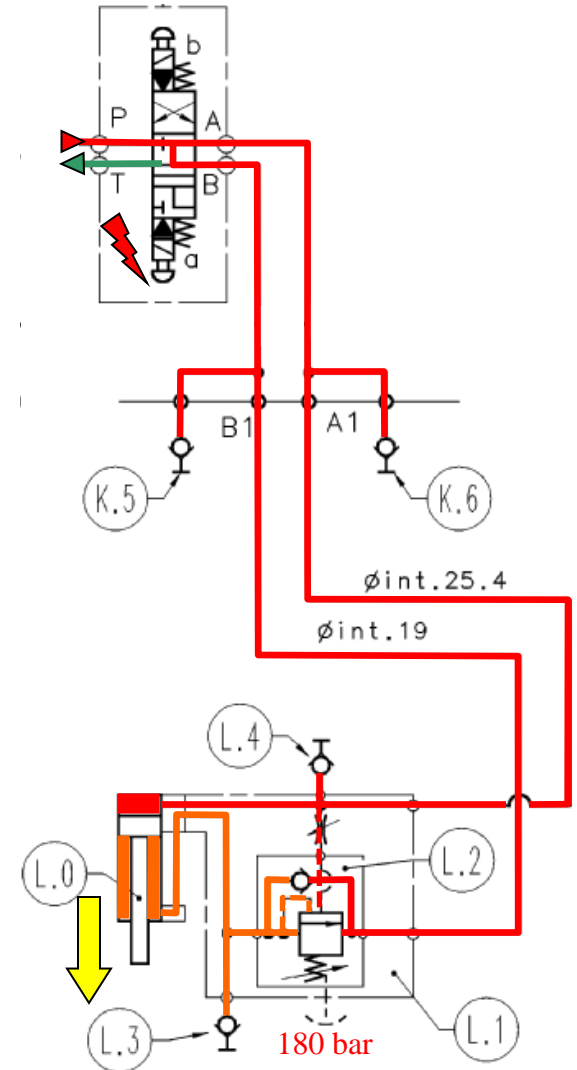
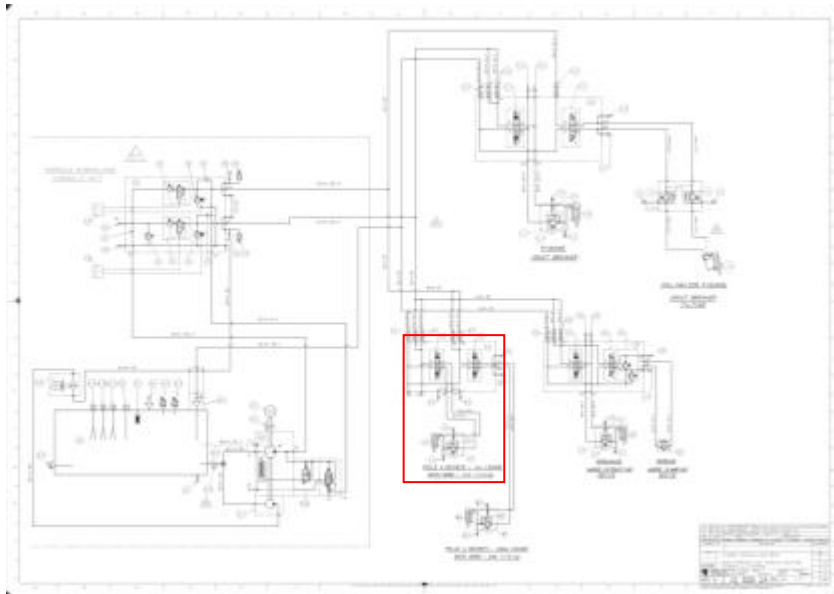
Distributor (a) is energized.

Regeneration in the distributor

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)



Cleaning shovel 2nd cylinder

Retracting of the rod:

Distributor (b) is energized.

Pressure: 160 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Extending of the rod:

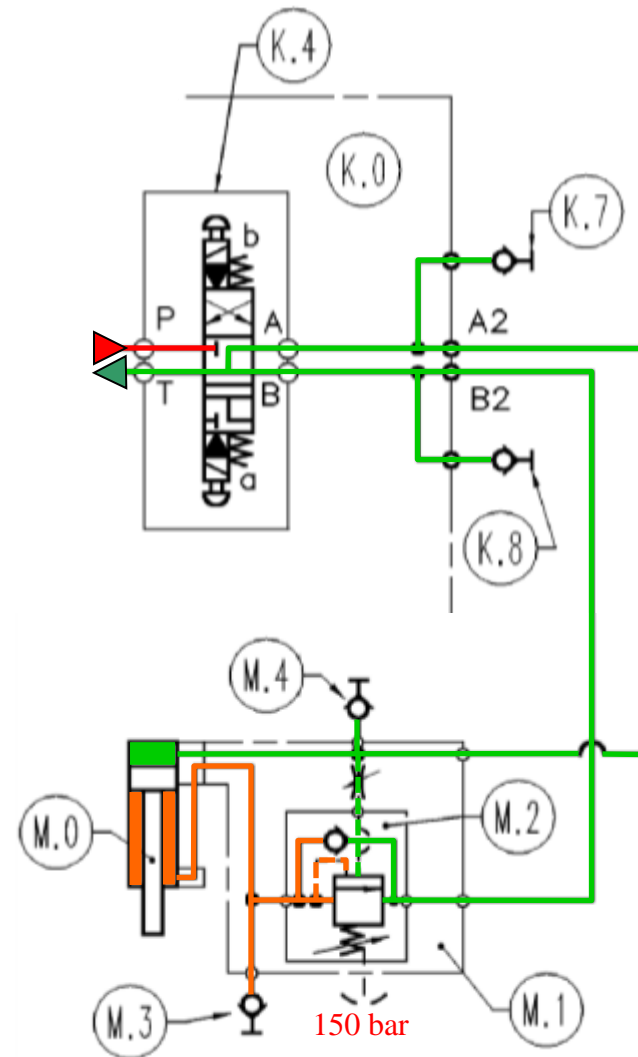
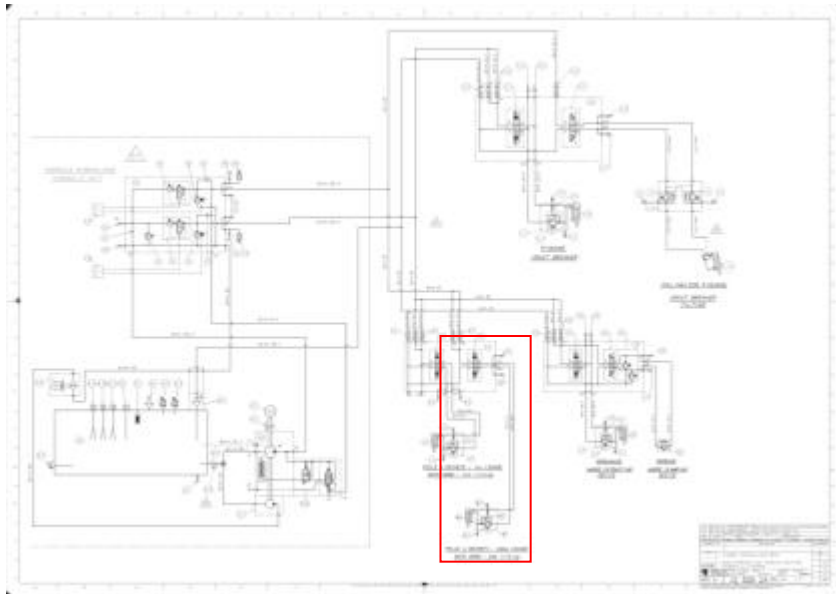
Distributor (a) is energized.

Regeneration in the distributor

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)



Cleaning shovel 2nd cylinder

Retracting of the rod:

Distributor (b) is energized.

Pressure: 160 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Extending of the rod:

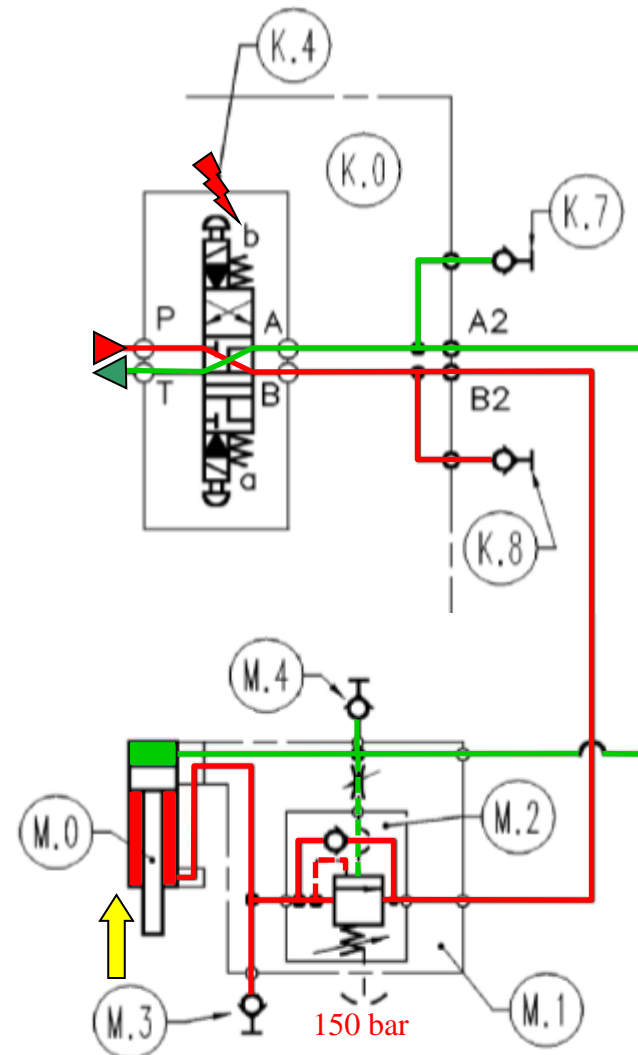
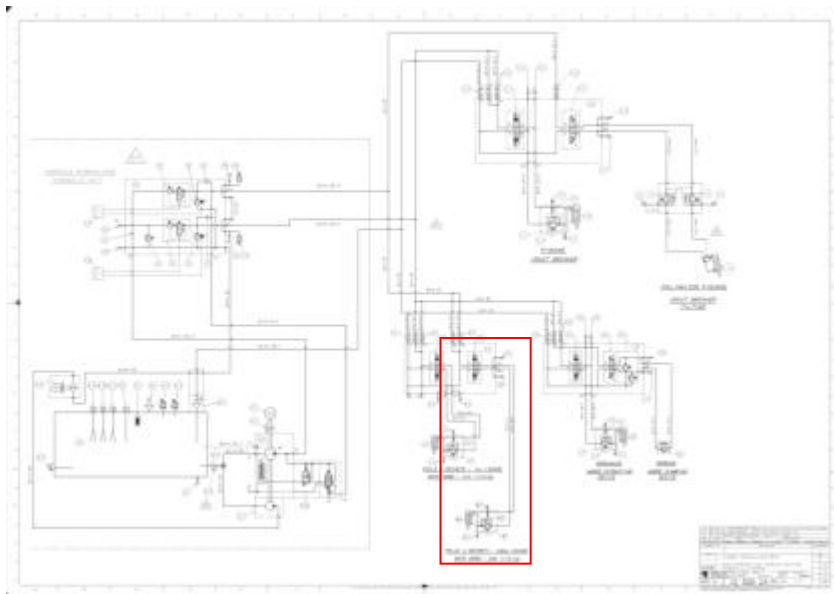
Distributor (a) is energized.

Regeneration in the distributor

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)



Cleaning shovel 2nd cylinder

Retracting of the rod:

Distributor (b) is energized.

Pressure: 160 bar

Flow: 51 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)

Extending of the rod:

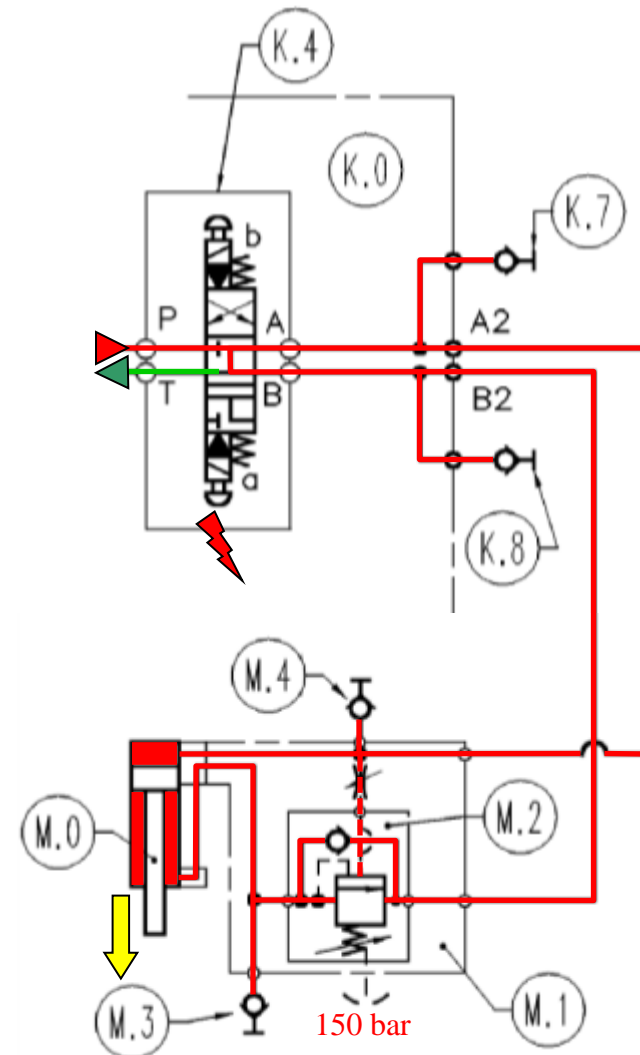
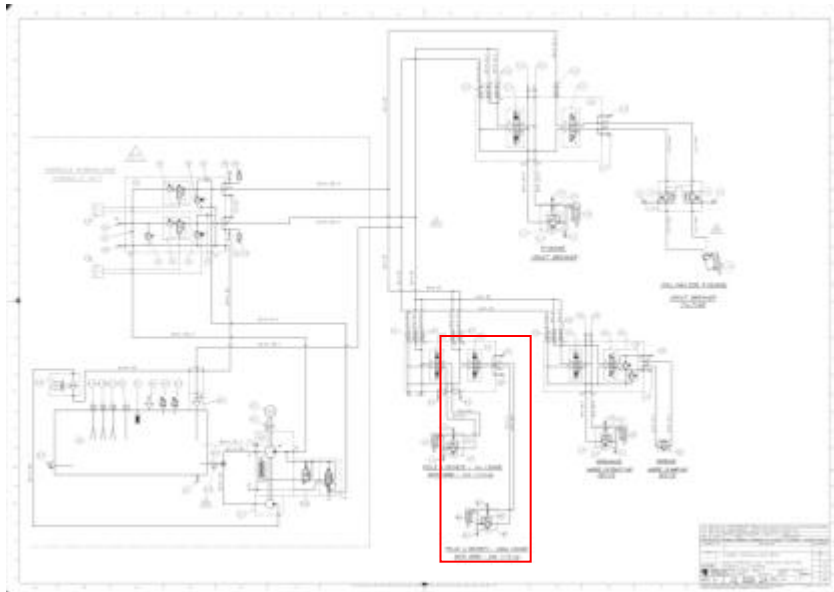
Distributor (a) is energized.

Regeneration in the distributor

Pressure: 30 bar

Flow: 49 l/mn in HS (20 m/mn)

Flow: 4 l/mn in LS (1.5 m/mn)





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MA'ADEN PROJECT

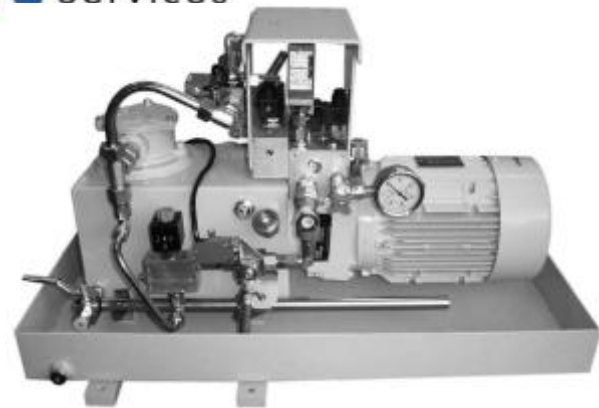
P1034 - PTM

POT TENDING MACHINE

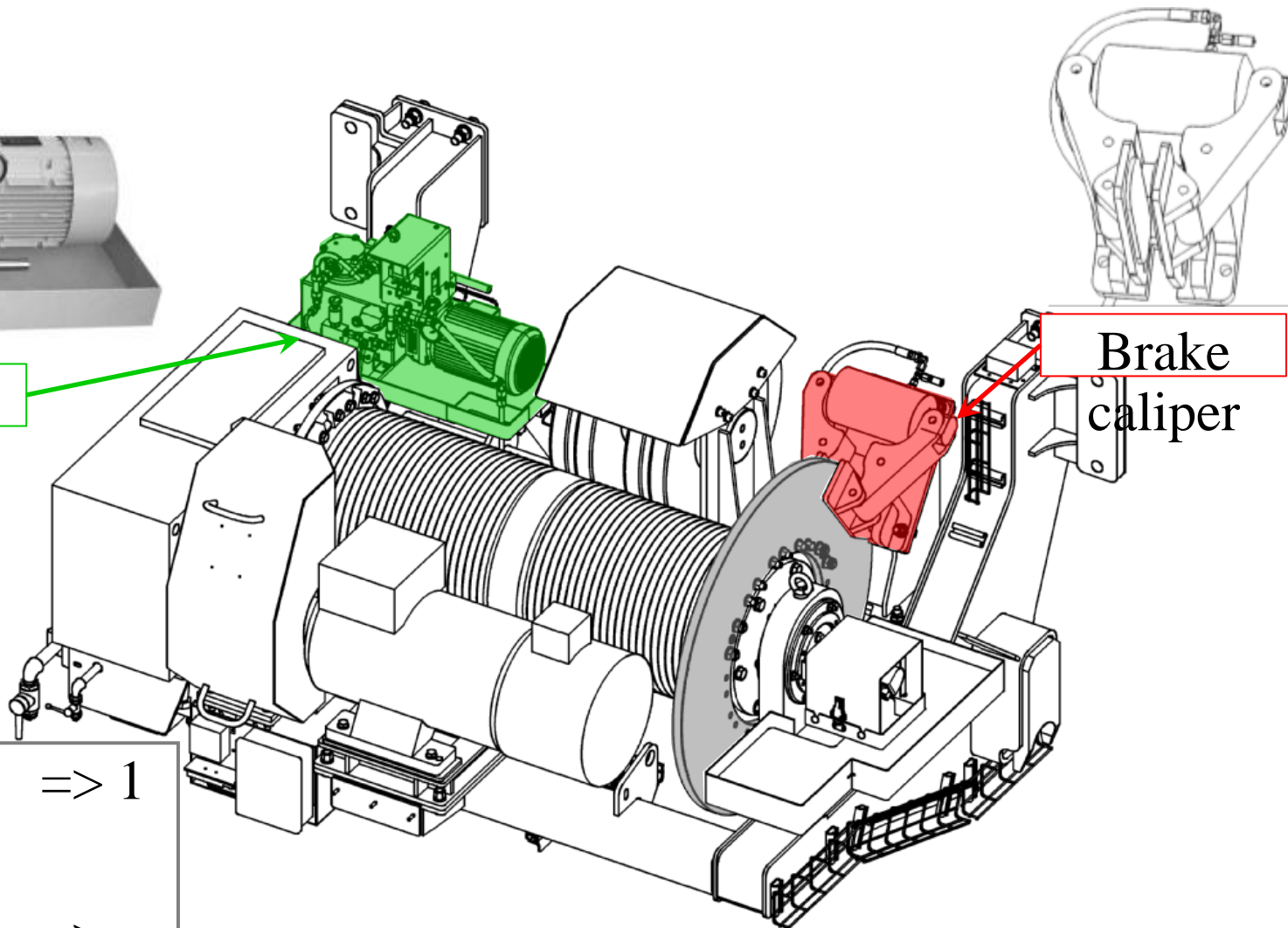
Safety brake TH9-3 with HU

FREIN DE SECURITE TH9 - 3

SAFETY BRAKE TH9 - 3



Hydraulic
power unit



Brake
caliper

Disc diameter \Rightarrow 1
030 mm

Static torque \Rightarrow
31 961 Nm

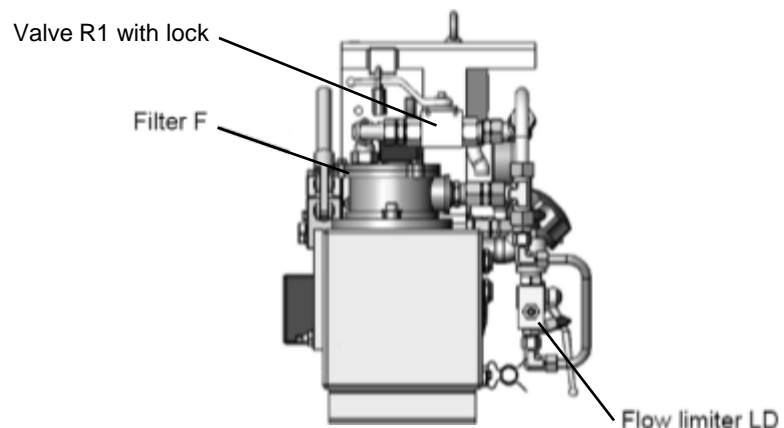
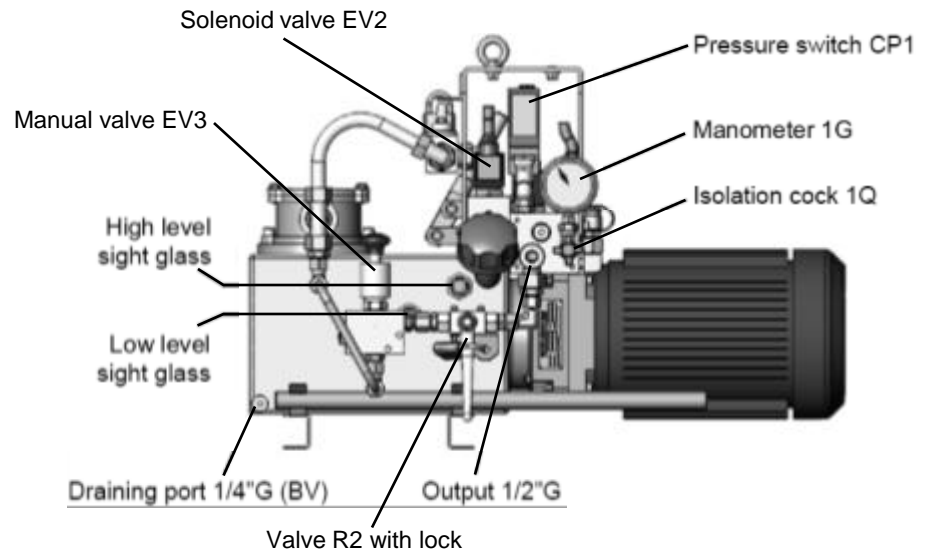
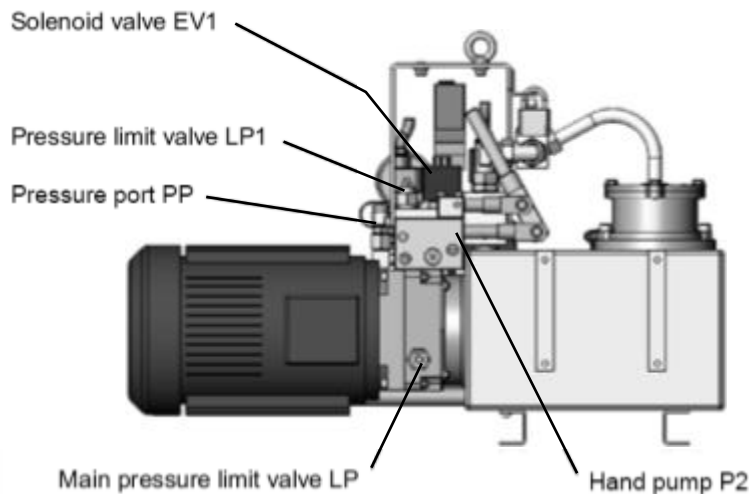
FREIN DE SECURITE TH9 - 3

SAFETY BRAKE TH9 - 3



CENTRALE HYDRAULIQUE CE8L

HYDRAULIC POWER UNIT CE8L



Technical data :

- Motor => 2.2 kW
- Flow => 10.0 l/mn (60 Hz)
- P MAX (LP) => 205 bar
- CP1 mini => 140



Brake open :

- Motor M running until $P=160\text{bar}$ (Maxi of CP1)
- Motor M stop when $140 < P < 160\text{ bar}$
- Motor M restart when $P < 140\text{ bar}$ (Mini of CP1)

Mini 140 bar
Maxi 160 bar

Caliper

Caliper

CP1

1G

1Q

PP

P2

CA

230 bar

LP1

205 bar

LP

M

P1

R

F

BR1

NV

BV

CR

EV1

EV2

OP4

OP4

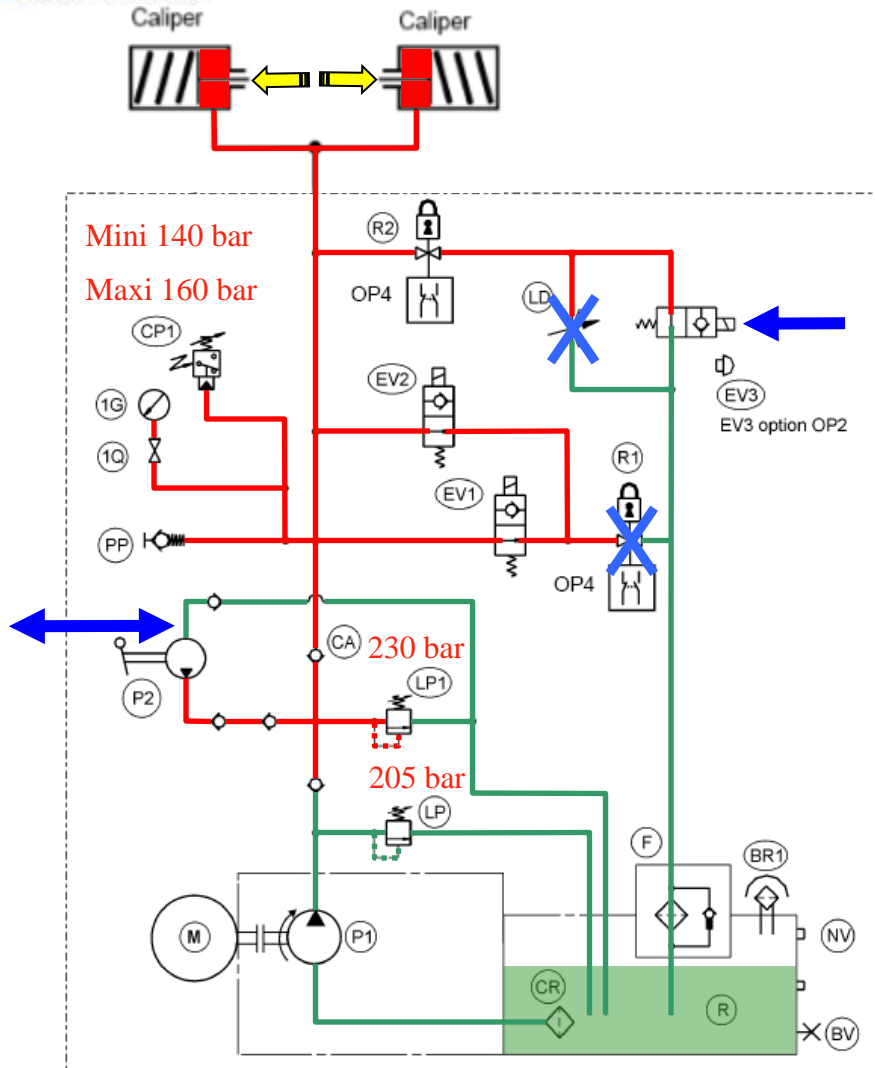
R1

R2

LD

EV3 option OP2

SCHEMA HYDRAULIQUE HYDRAULIC DIAGRAM



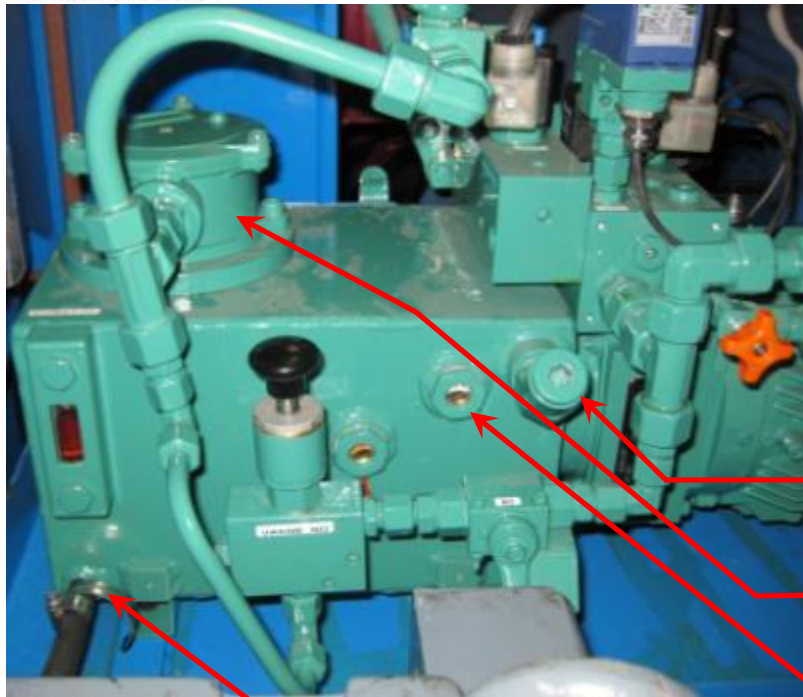
Manual
opening

Brake open :

- Valve R1 must be close
- Open valve R2
- Close flow limiter LD
- Open tape 1Q to read pressure on manometer 1G
- Press manual valve EV3
- Activate hand pump P2
- Brake will be normaly open from 140 bar

CENTRALE HYDRAULIQUE CE8L

HYDRAULIC POWER UNIT CE8L



Preventive maintenance

∴

- Oil filter cleaning :

Every 6 months

Oil & Filter change :

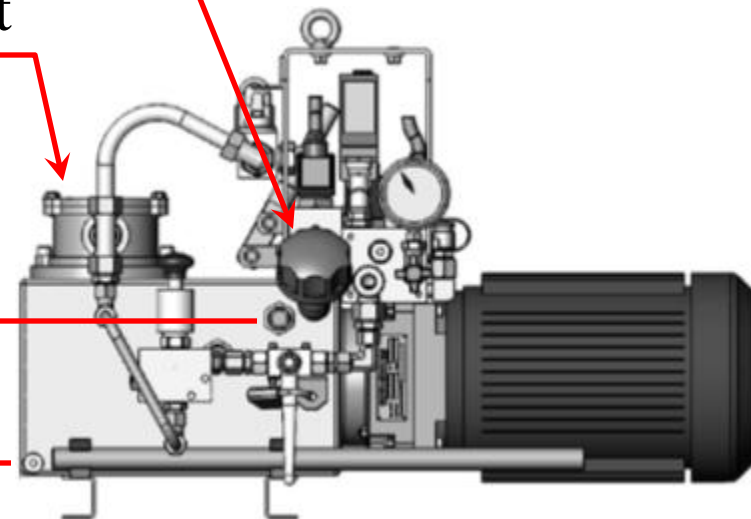
Every 15 years

8 L

Filling

point

Oil
filter

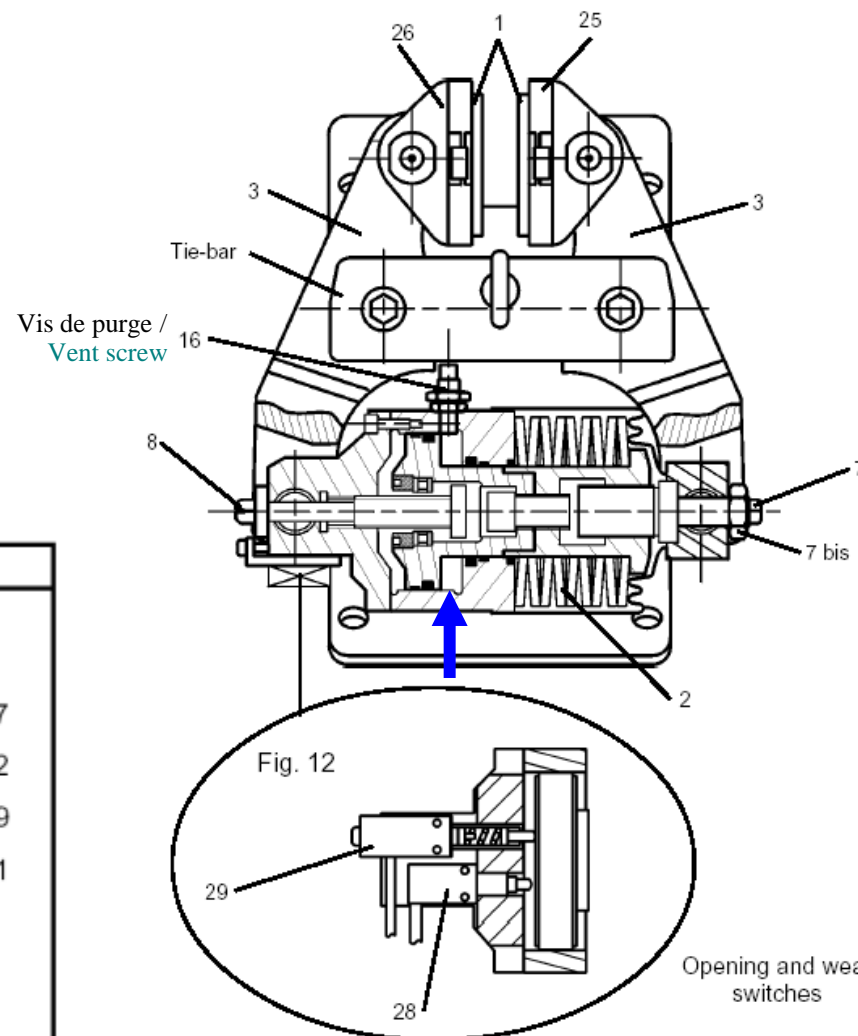






COUPE DU FREIN TH9

SECTION VIEW OF THE BRAKE TH9

Ouverture: Pression d'huile
Fermeture: Rondelles ressort /

Opening: Oil pressure
Closing: Spring washers

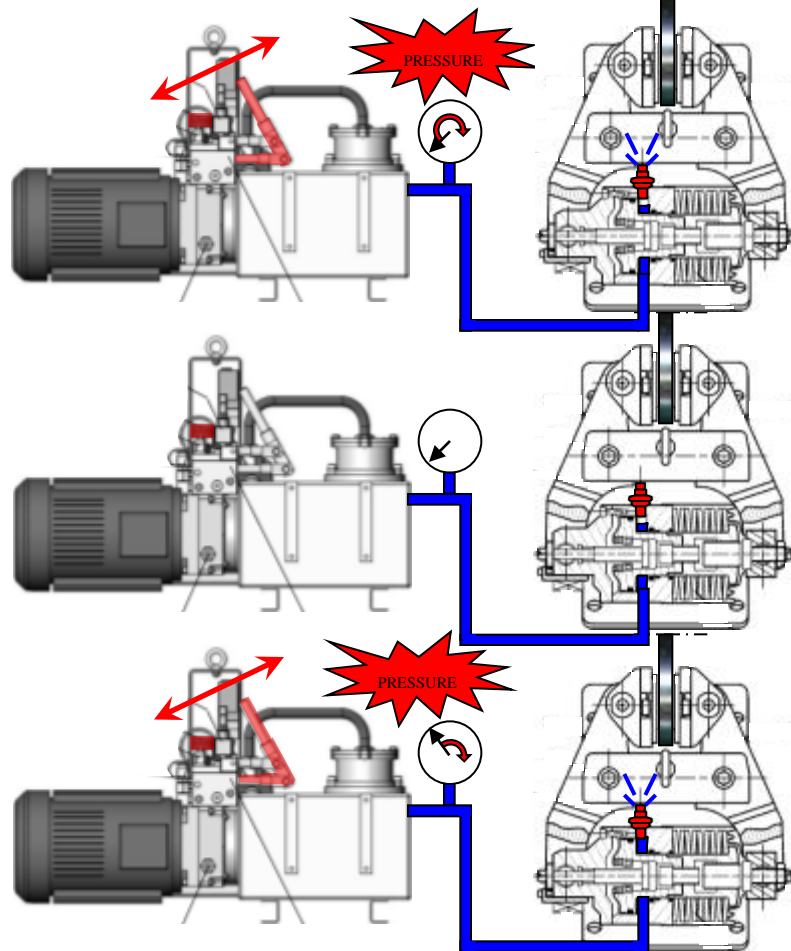


Ref.	Designation	Tools
1	Lining pads	
2	Braking spring	
3	Pivoting arms	
7	Lining wear compensation screw -	 17
7bis	Lock nut of the screw (7) -----	 32
8	Manual release screw -----	 19
16	Purge screw -----	 11
25	Right shoe	
26	Left shoe	
28	Opening proving switch C300	
29	Lining wear proving switch C400	

PURGE VENTING

Frein avant procédure / Brake before procedure :

*Pression d'huile faible (<140 bars), le frein ne s'ouvre pas /
Low oil pressure (<140 bars), the brake can't open.*



Frein après procédure / Brake after procedure :

*La pression d'huile est comprise entre 140 et 160 bars, le frein s'ouvre /
The oil pressure is between 140 and 160 bars, the brake can open.*

1

- Remplir le réservoir de la centrale / **Fill up the tank of HU.**
- Fermer le limiteur de débit LD1 / **Close flow limiter LD1**
- Pressuriser le frein avec la pompe manuelle et desserrer la vis de purge afin de retirer l'air du circuit / **Pressurize the caliper with the hand pump and loosen the vent screw to remove the air from the brake.**
- Resserrer la vis de purge / **Tight the vent screw.**

2

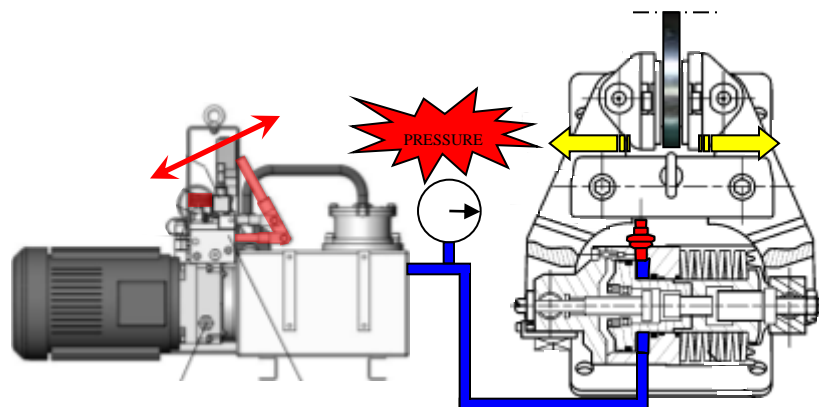
- Relâcher la pression d'huile en ouvrant LD1 / **Release the oil pressure by opening flow limiter LD1.**
- Compléter le niveau d'huile si nécessaire / **Complete oil level if necessary.**

3

- Répéter l'opération "1" et "2" jusqu'à ce que le jet d'huile de la vis de purge soit exempt d'air / **Repeat the operation "1" and "2" till obtaining an oil stream free of air from the vent screw.**

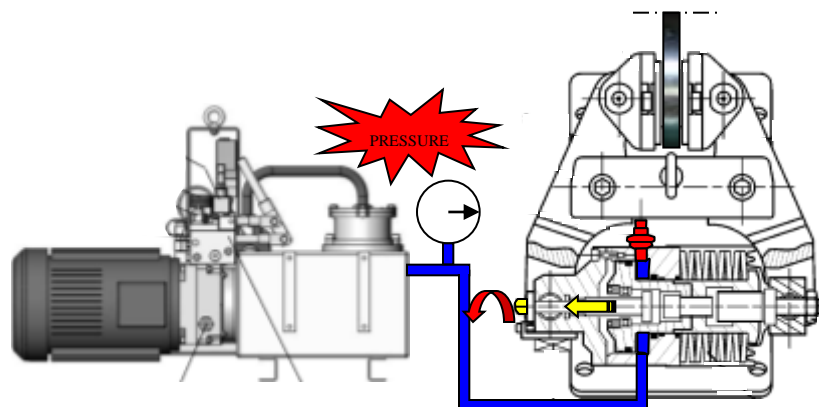
CHANGEMENT D'UN JEU DE PLAQUETTE

LINING PADS REPLACEMENT



1

- Fermer le limiteur de débit LD1 / Close flow limiter LD1
- Pressuriser le frein / Pressurize the caliper.

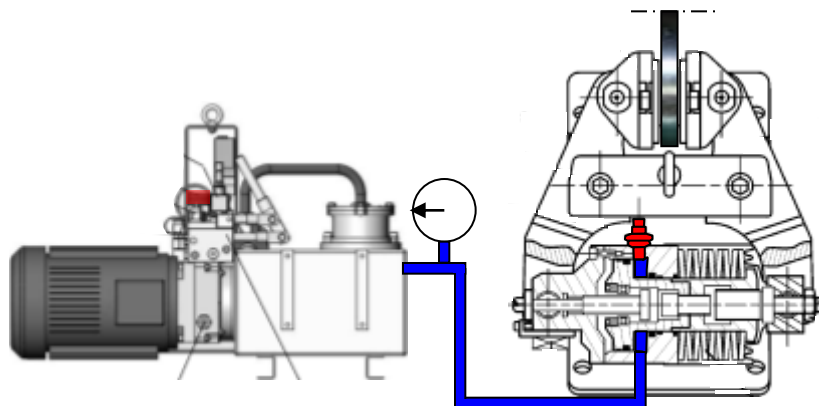


2

- Desserrer totalement la vis d'ajustement / Loosen totally the adjustment screw

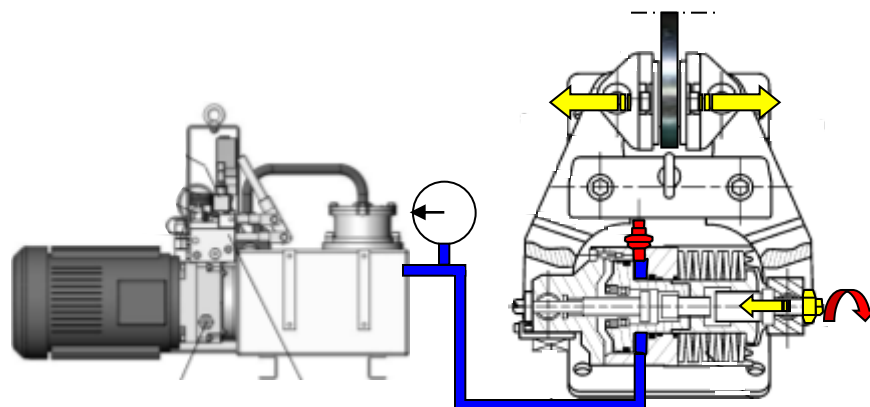
CHANGEMENT D'UN JEU DE PLAQUETTE

LINING PADS REPLACEMENT



3

-Relâcher la pression d'huile en ouvrant LD1 / Release the oil pressure by opening flow limiter LD1.



4

-Déserrer le contre-écrou puis visser la vis de compensation / Loose lock nut (7 bis) and screw the compensation screw (7)

-Retirer les plaquettes usées / Remove the worn pads

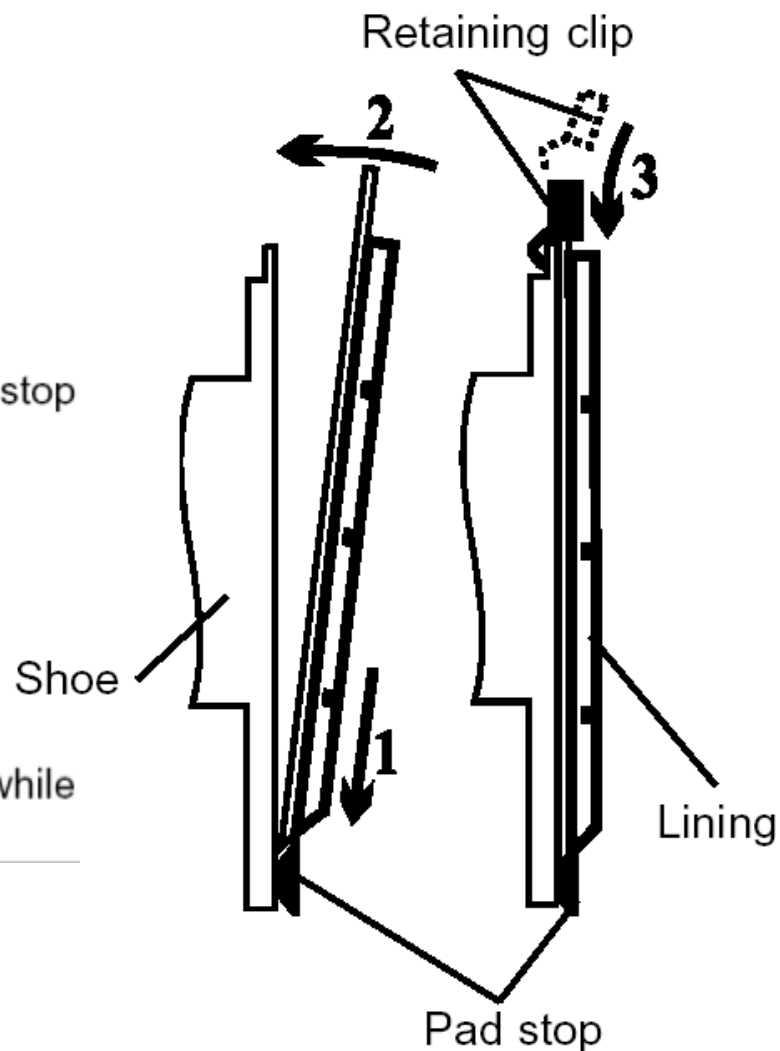
CHANGEMENT D'UN JEU DE PLAQUETTE

LINING PADS REPLACEMENT

5

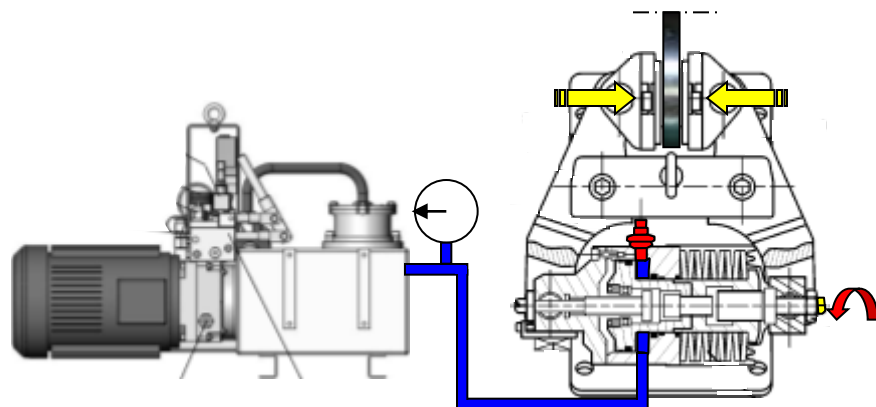
-Installer les nouvelles plaquettes / [Place the new lining pads](#)

- 1) Hook the pad (1), without its retaining clip, behind the stop situated at bottom of the shoe (25 and 26)
- 2) Embed the pad into its recess
- 3) Engage the retaining clip fully on the pad shank while hooking it on the upper end of the shoe (25 and 26).



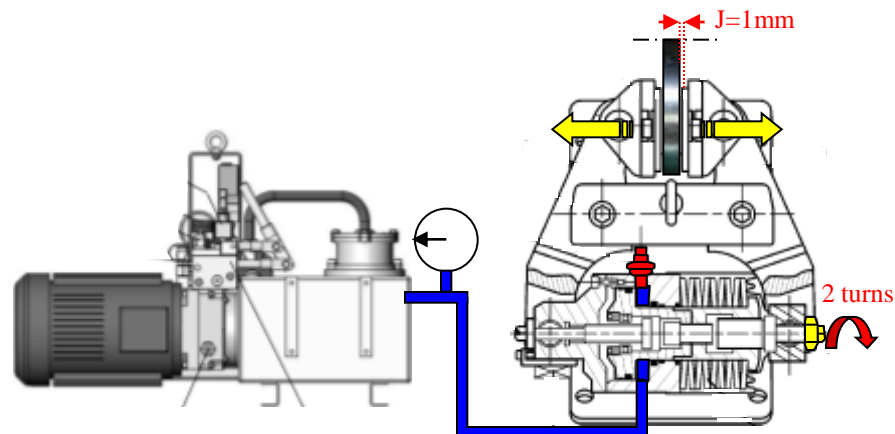
CHANGEMENT D'UN JEU DE PLAQUETTE

LINING PADS REPLACEMENT



6

-Dé-visser la vis de compensation pour mettre en contact les plaquettes avec le disque / Unscrew the compensation screw (7) to bring the linings in contact with the disc



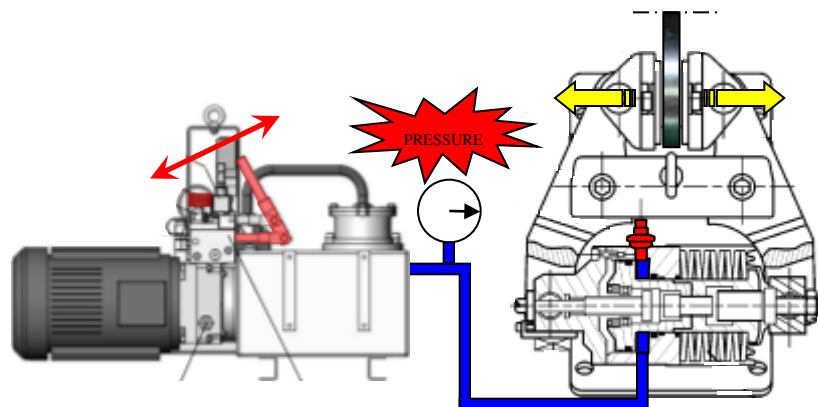
7

-Tourner de 2 tours la vis de compensation afin d'avoir 1 mm de jeu entre le disque et les plaquettes / Then screw this compensation screw (7) for 2 turns, which corresponds to 1 mm gap between disc and lining

-Serrer l'écrou / Lock the lock nut (7 bis)

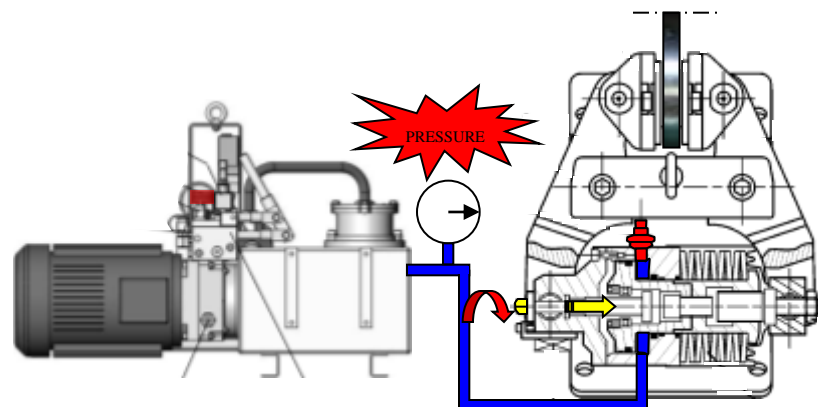
CHANGEMENT D'UN JEU DE PLAQUETTE

LINING PADS REPLACEMENT



8

- Fermer le limiteur de débit LD1 / **Close flow limiter LD1**
- Pressuriser le frein / **Pressurize the caliper.**



9

- Resserrer la vis d'ouverture jusqu'à ce que le frein soit déverrouillé mécaniquement / **Screw the manual release screw (8) until its stop to mechanically unlock the brake**
- Activer le frein plusieurs fois pour s'assurer du bon fonctionnement de l'ensemble / **Operate the brake a few times, to ensure the good functioning of the brake**
- Relâcher la pression d'huile en ouvrant LD1 / **Release the oil pressure by opening flow limiter LD1.**



<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

**THANK YOU FOR YOUR
ATTENTION**

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

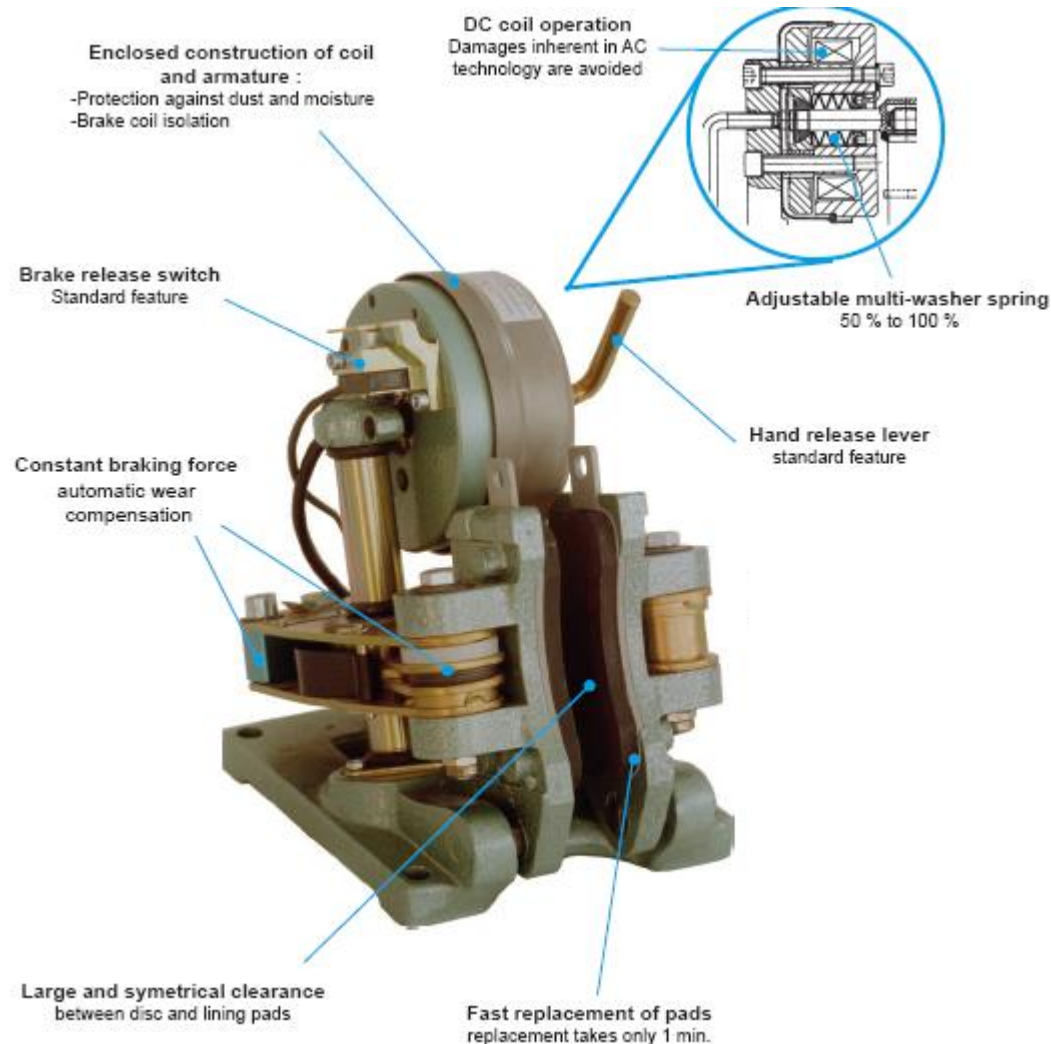
MA'ADEN PROJECT

P1034 - PTM

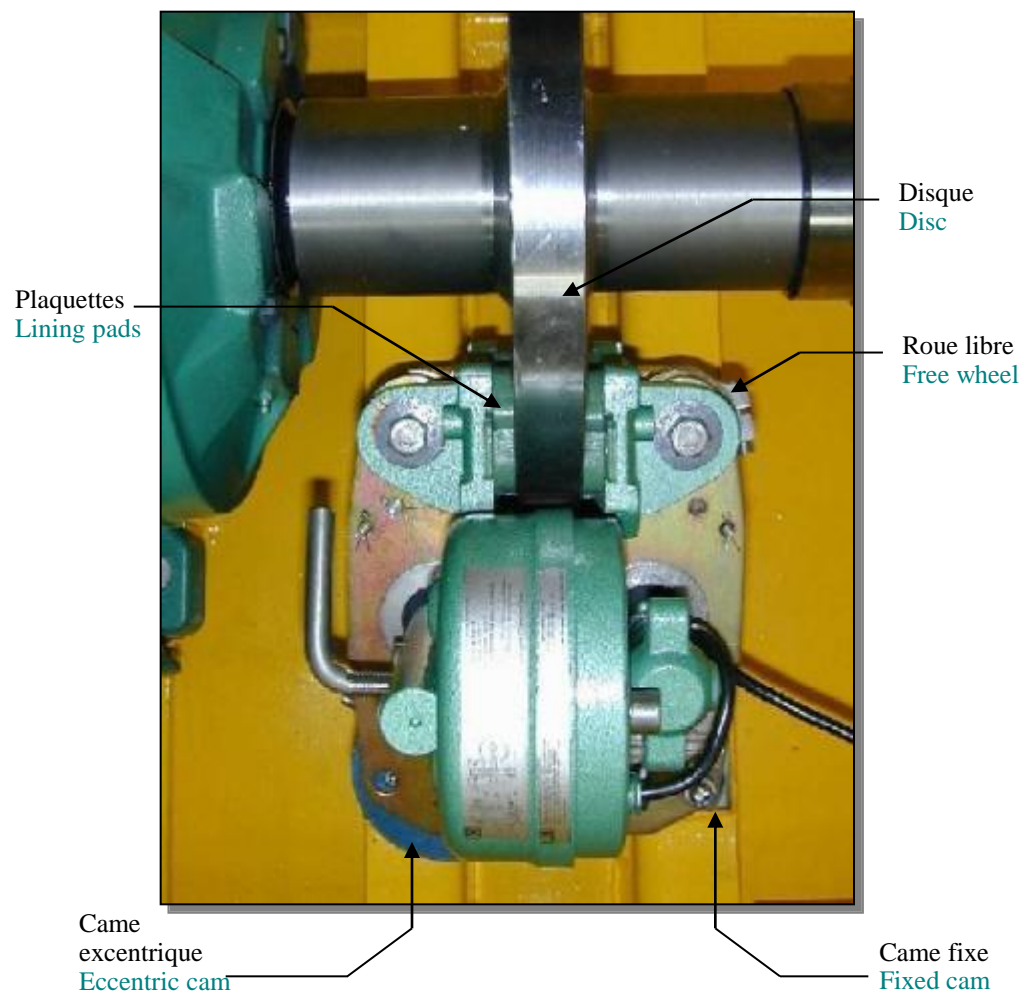
POT TENDING MACHINE

Compensated brake Type 52

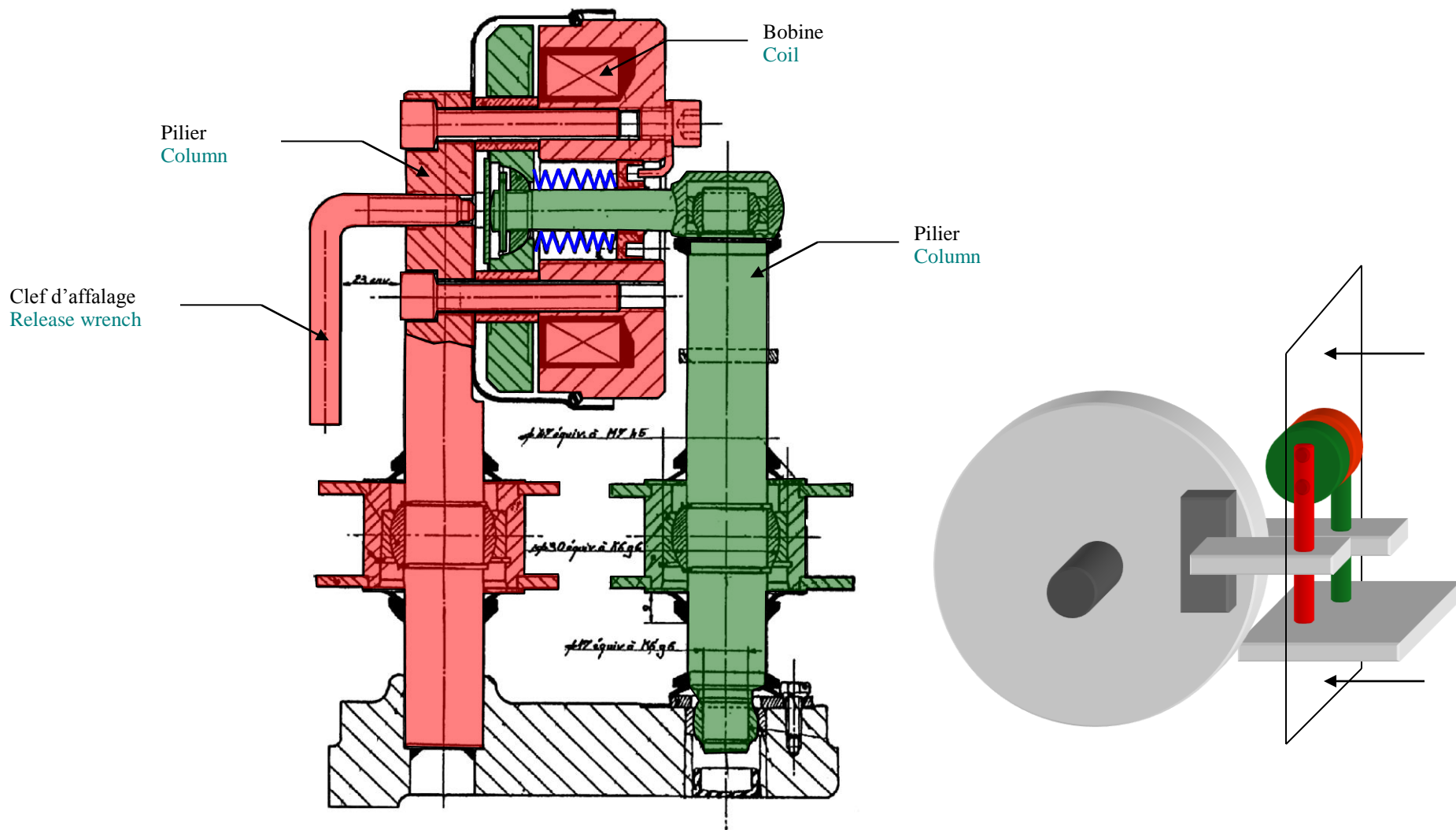
VUE REELLE PHOTOGRAPHIC VIEW



VUE REELLE PHOTOGRAPHIC VIEW

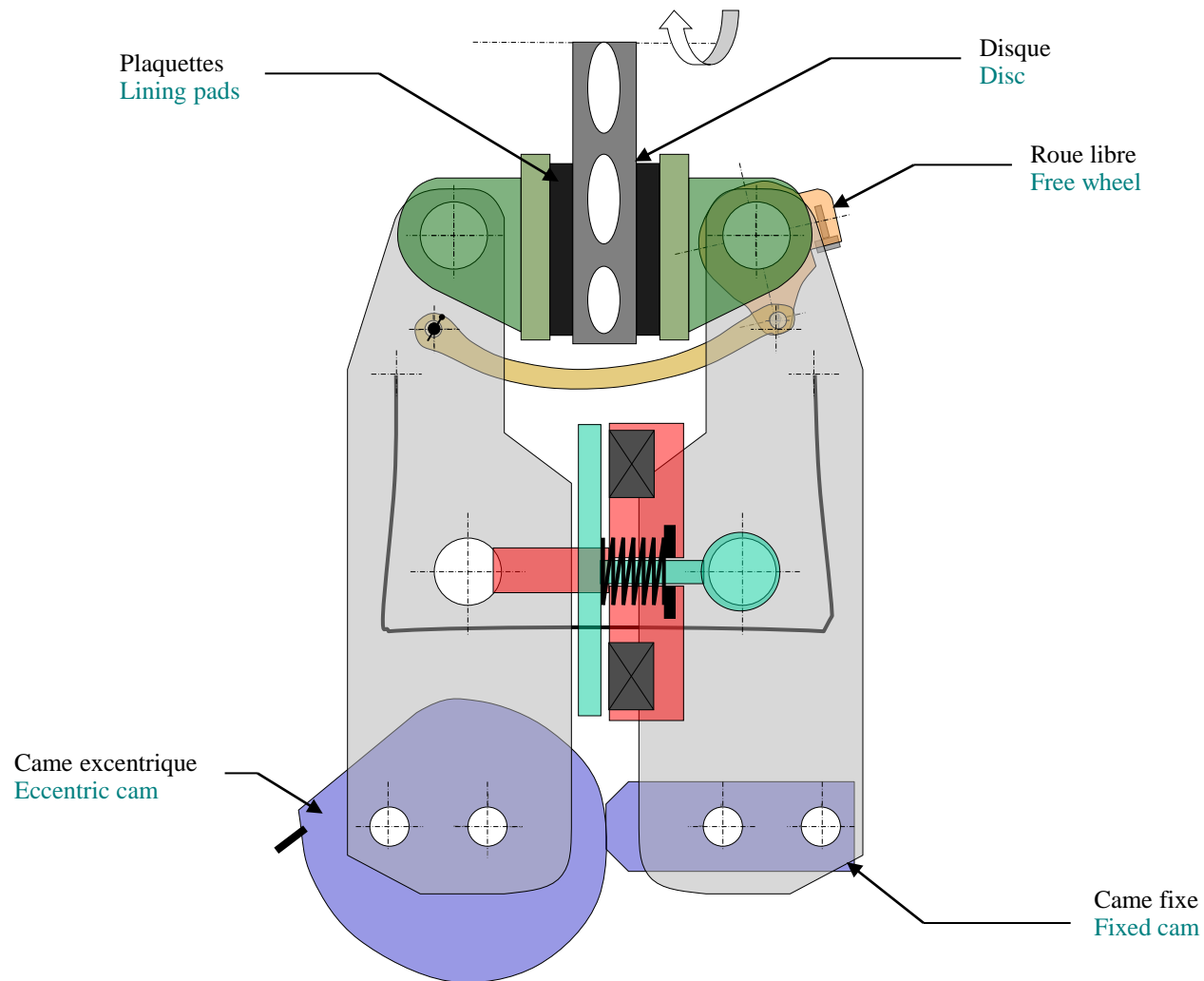


COUPE SECTION VIEW



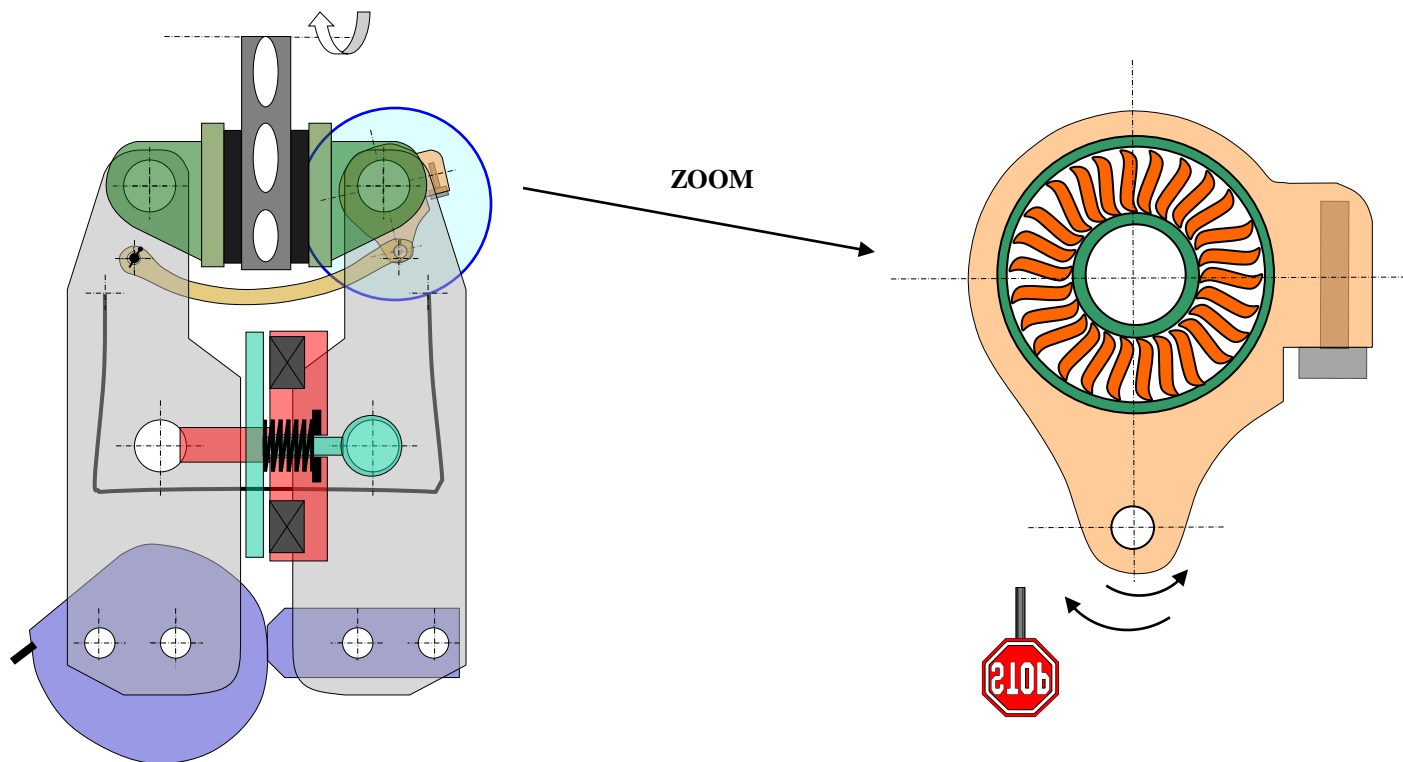
SCHEMA

SCHEMATIC VIEW



DETAIL DE LA ROUE LIBRE

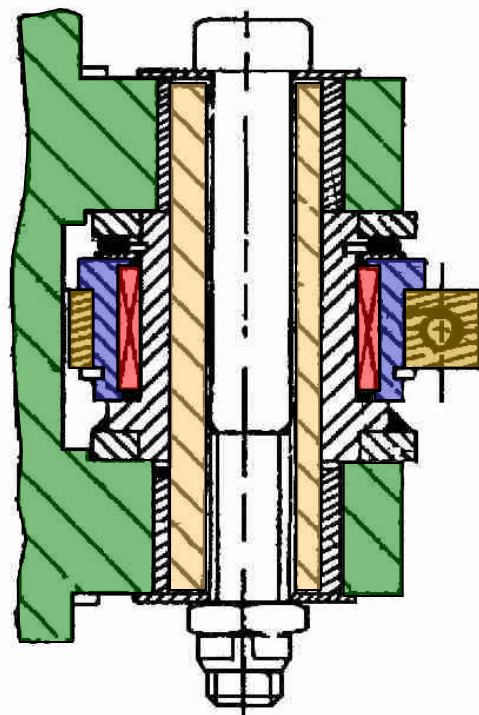
FREE WHEEL VIEW



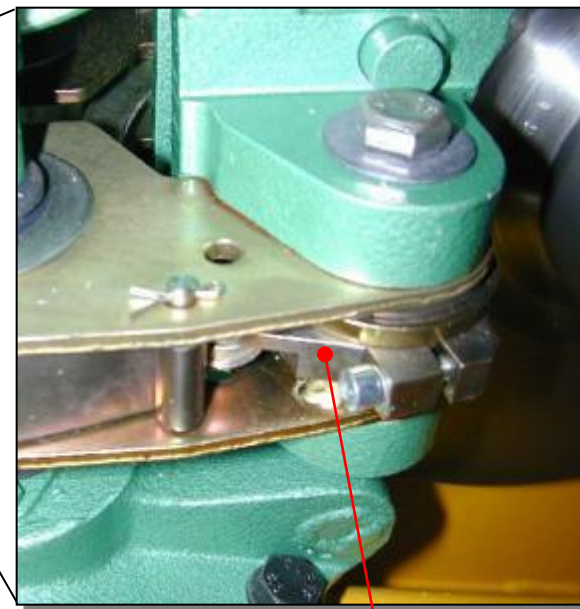
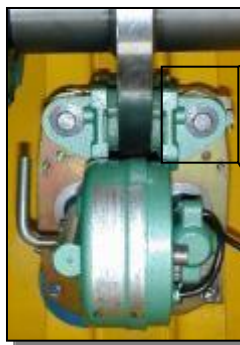
La roue libre permet une rotation dans un sens et un blocage dans l'autre.
The free wheel allow a rotation in one way and a locking in the other way.

DETAIL DE LA ROUE LIBRE

FREE WHEEL VIEW



Bras
Caliper arms

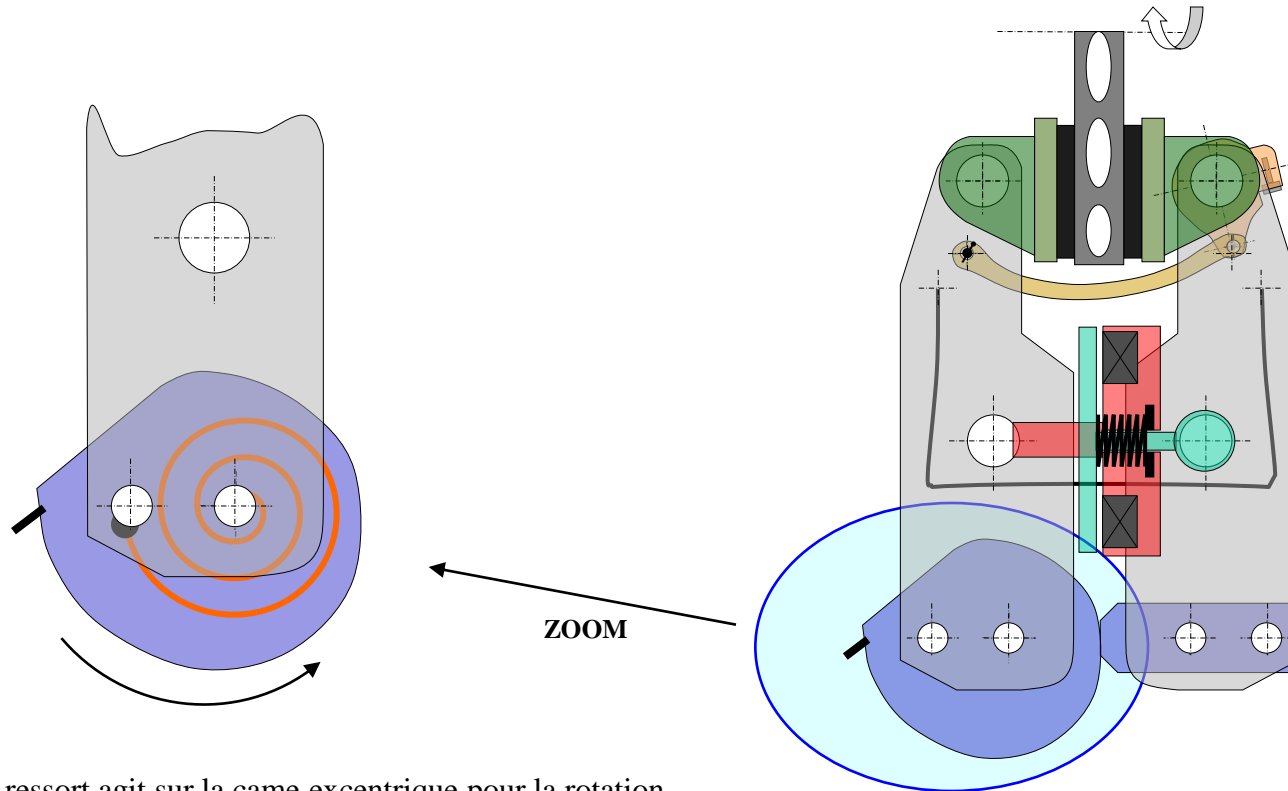


Roue libre
Free wheel



DETAIL DE LA CAME EXCENTRIQUE

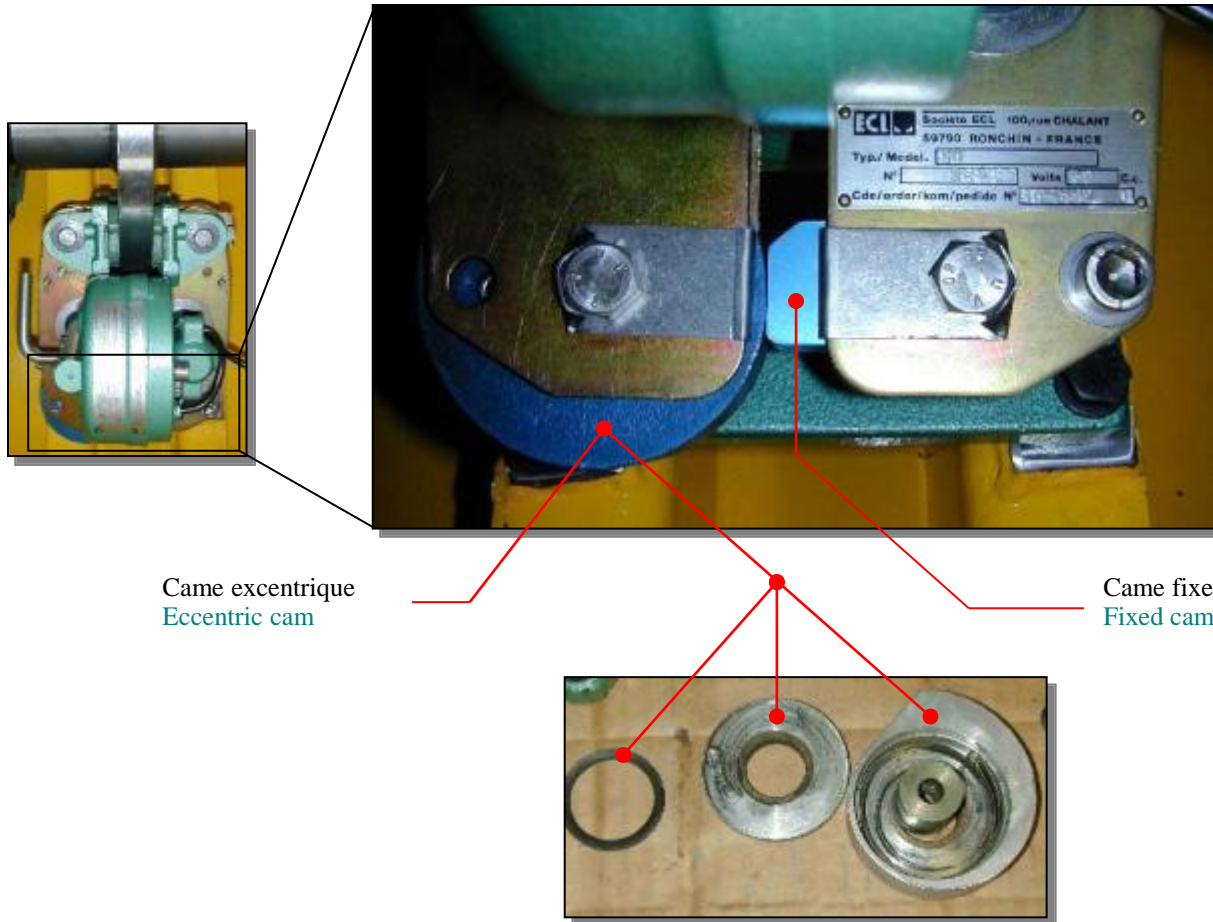
ECCENTRIC CAM VIEW



Un ressort agit sur la came excentrique pour la rotation.
A spring acts on the eccentric cam for rotation.

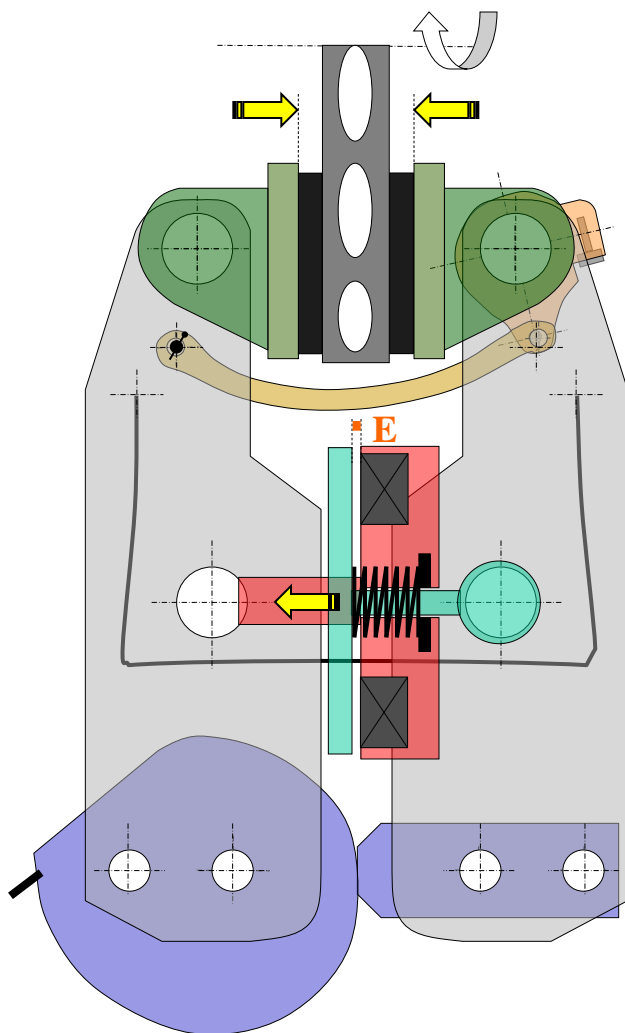
DETAIL DE LA CAME EXCENTRIQUE

ECCENTRIC CAM VIEW



PHASES DE FONCTIONNEMENT

OPERATING STEPS



1

Début du coup de frein / **Beginning of braking.**

Motor et frein hors tension.
Entrefer **E** au moment où les garnitures commencent à pincer le disque en rotation.

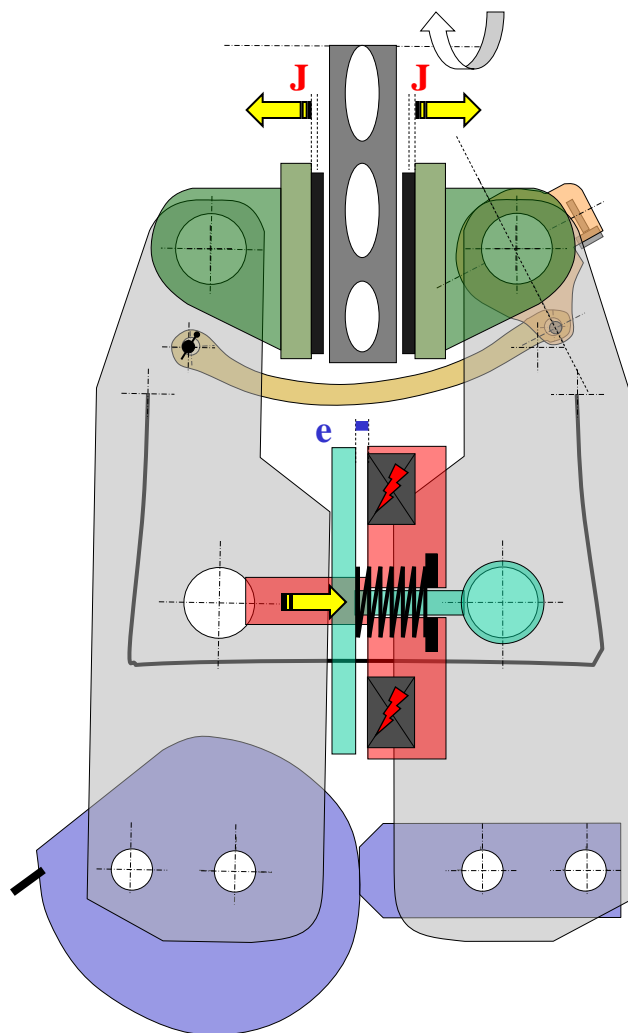
Motor and brake desenergized
E = air gap when the lining pads come in contact with the disk in rotation



α = free wheel rotation

PHASES DE FONCTIONNEMENT

OPERATING STEPS



3a

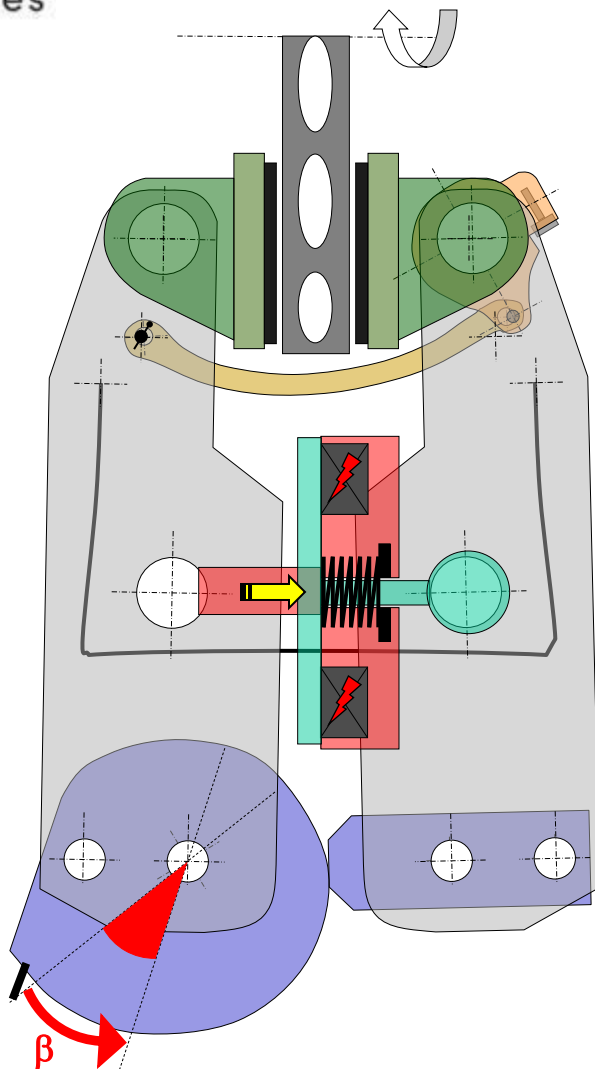
Redémarrage / Restarting

Dégagement des garnitures limité à la valeur **J**
par l'action de la roue libre.

Motor and brake energized
Free wheel limits the opening at the value **J+J**
Its remains an air gap = **e**.

PHASES DE FONCTIONNEMENT

OPERATING STEPS



3b

Rattrapage du jeu "e" / **Wear compensation.**

Entrefer nul.
Fin de rotation de la came.

Motor and brake energized
The solenoid armature finishes its stroke and pulls the fixed cam.
The eccentric cam turns to compensate the wear of the lining pads.

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

REEMPLACEMENT DES PLAQUETTES LINING PADS REPLACEMENT

REPLACEMENT DES PLAQUETTES

LINING PADS REPLACEMENT



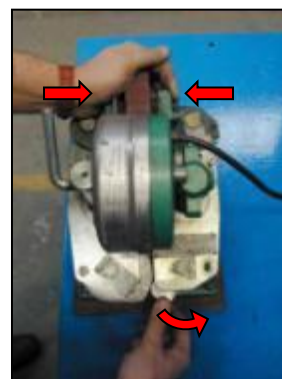
- ☐ Visser la clé au centre de l'électro-aimant pour libérer les plaquettes.
- ☐ Screw manual release wrench to free the pads.



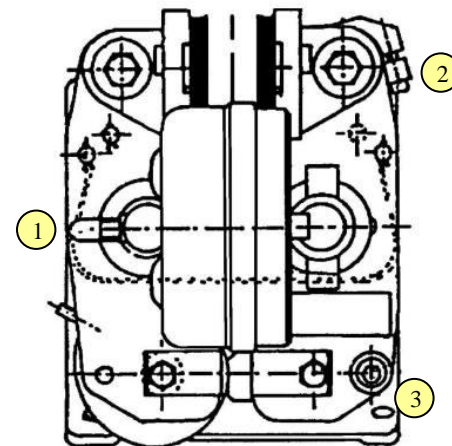
- ☐ Débrayer la roue libre en agissant sur sa vis de serrage (desserrer ½ tour).
- ☐ Unscrew the free wheel screw.



- ☐ Enlever la vis d'arrêt en rotation de la came fixe.
- ☐ Remove fixed cam stop screw.

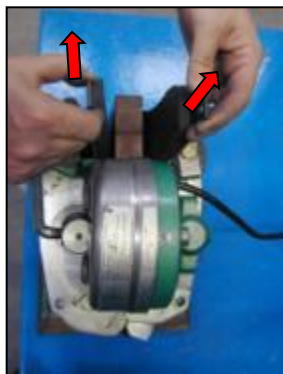


- ☐ Dégager la came fixe de 90° vers l'arrière.
- ☐ Swing the fixed cam out of the way by 90°.

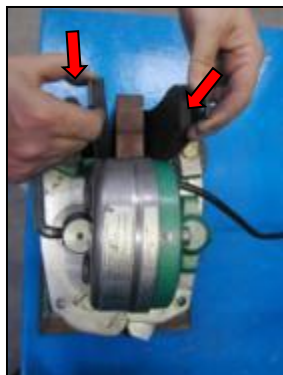


REEMPLACEMENT DES PLAQUETTES

LINING PADS REPLACEMENT



- Enlever les plaquettes.
- Remove the lining pads.



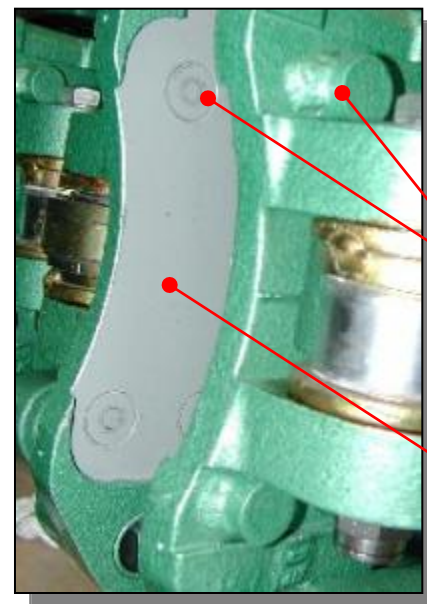
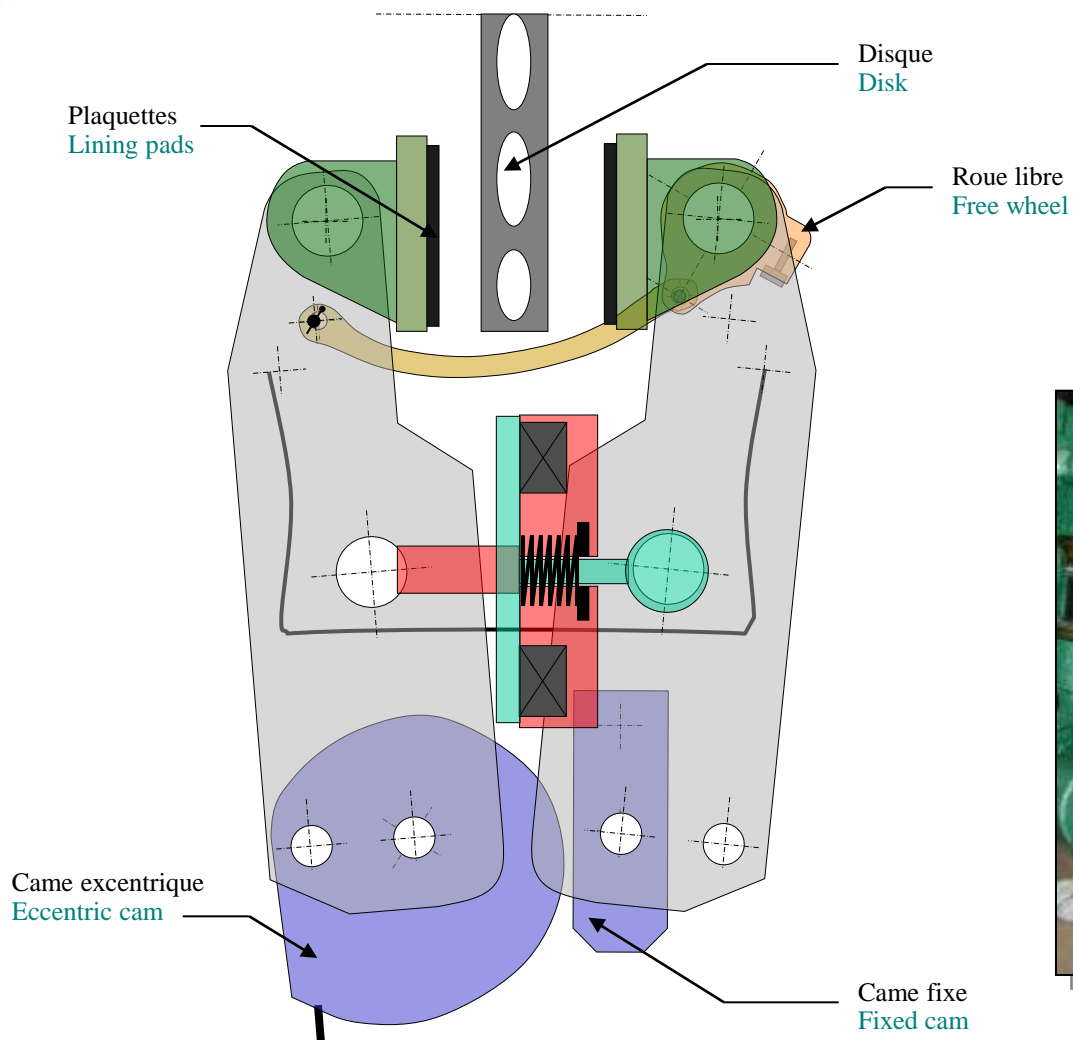
- Replacer les plaquettes neuves en veillant à les encastrer correctement dans leur logement.
- Fit the new pads, taking care that they are correctly secured in their housings which should be free from dirt.

IMPORTANT :

Vérifier que le disque soit propre et non gras.
Check that the disc is clean and not greasy or oily.
Vérifier aussi les plaquettes.
Check also the lining pads.

REPLACEMENT DES PLAQUETTES

LINING PADS REPLACEMENT

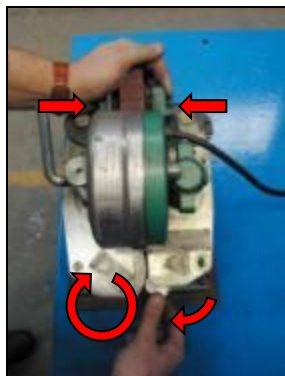


Aimants / Magnets

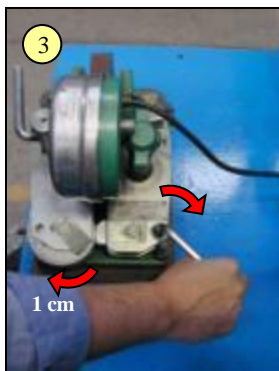
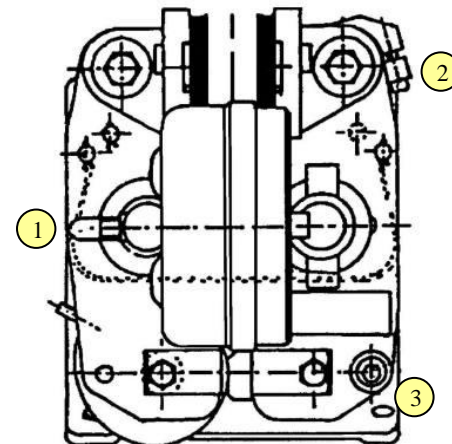
Plaquettes retirées / Lining pads removed

REEMPLACEMENT DES PLAQUETTES

LINING PADS REPLACEMENT



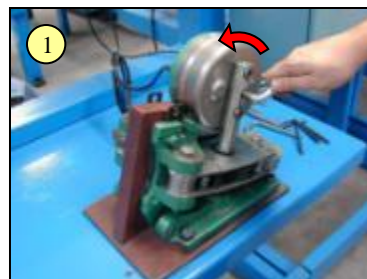
- ☐ Ramener les bras de la pince en appuyant sur l'avant des bras.
- ☐ Mettre la came excentrique dans la position maxi.
- ☐ Tourner la came fixe de 90° jusqu'à pouvoir remettre la vis.
- ☐ Les garnitures étant en contact sur le disque la came excentrique se met en position d'elle même sous l'effet de son ressort intérieur.
- ☐ Bring the caliper arms back to their initial position by pressing their front ends together.
- ☐ Turn the eccentric cam against the force of its springs as far as it will go.
- ☐ Rotate the fixed cam until screw can be replaced.
- ☐ The pads being into contact with the disc the eccentric cam will come into position by itself due to the action of its internal spring.



- ☐ Serrer la vis de la came fixe.
- ☐ Tourner dans le sens horaire la came excentrique de 1cm sur sa périphérie.
- ☐ Tight the fixed cam screw.
- ☐ Turn clockwise the eccentric cam of 1cm on its periphery



- ☐ Bloquer la vis située sur le collier du boîtier de la roue libre.
- ☐ Tight the free wheel screw.



- ☐ Dévisser la clé au centre de l'électro-aimant de 10 mm (environ 7 tours). Le frein est serré.
- ☐ Unscrew the manual release wrench by 10mm (approx. 7 turns). The brake will then be applied.

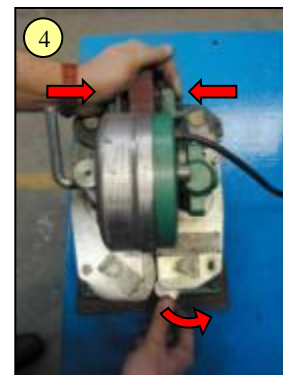
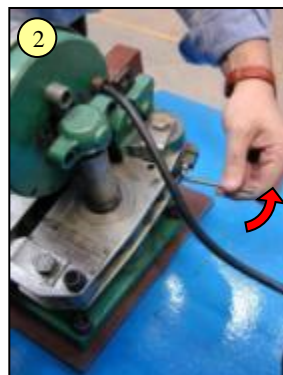
EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

REGLAGE DU COUPLE DE FREINAGE

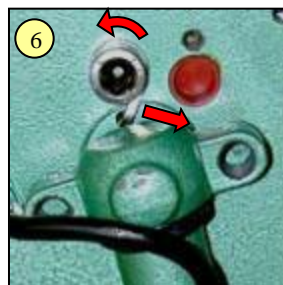
BRAKING TORQUE ADJUSTMENT

REGLAGE DU COUPLE DE FREINAGE BRAKING TORQUE ADJUSTMENT

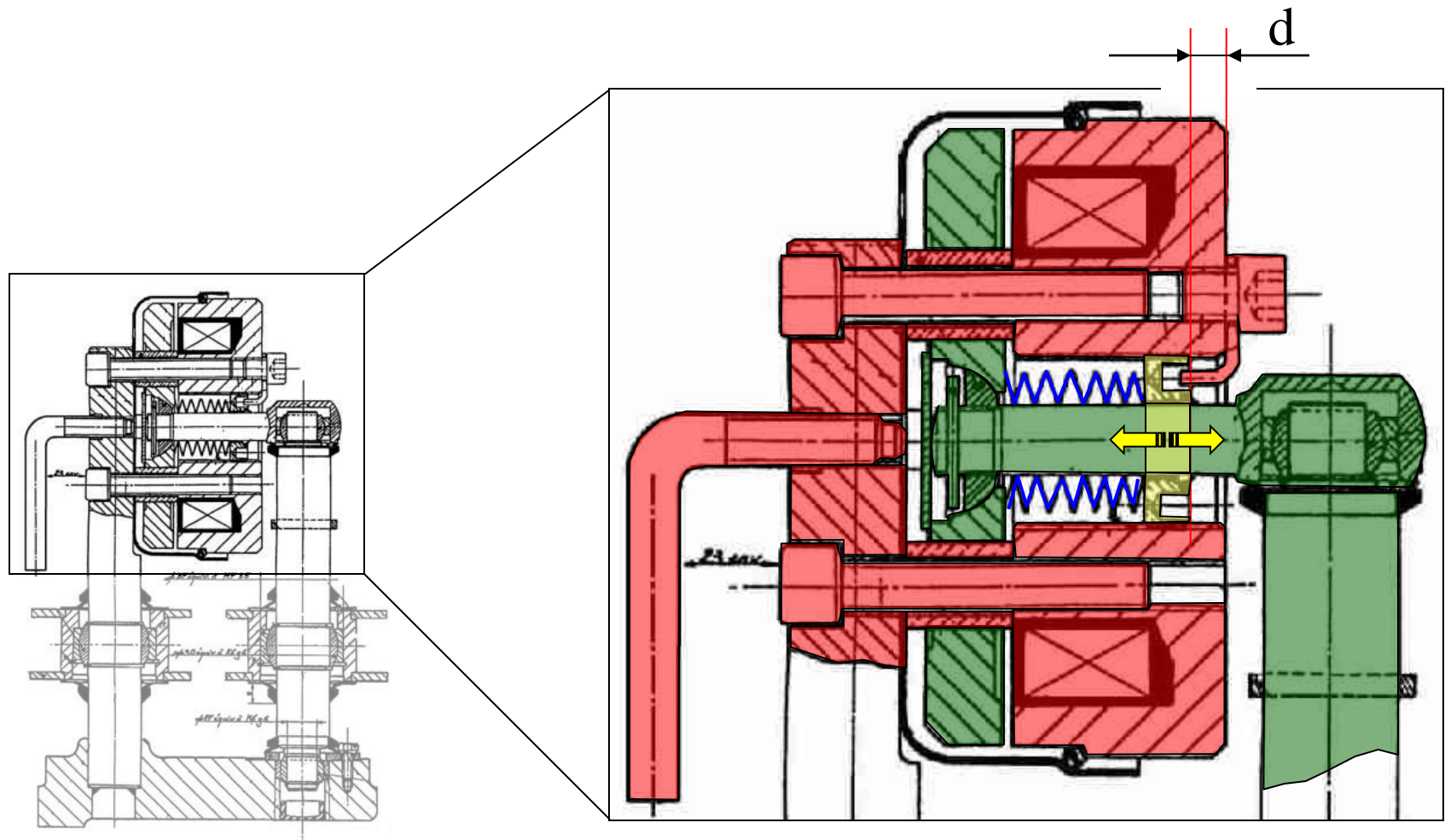
Enlever les plaquettes / Remove the lining pads



**Retirer l'ergot d'arrêt et desserrer la clef d'affalage
Remove the retaining wires and unscrew the manual release wrench**



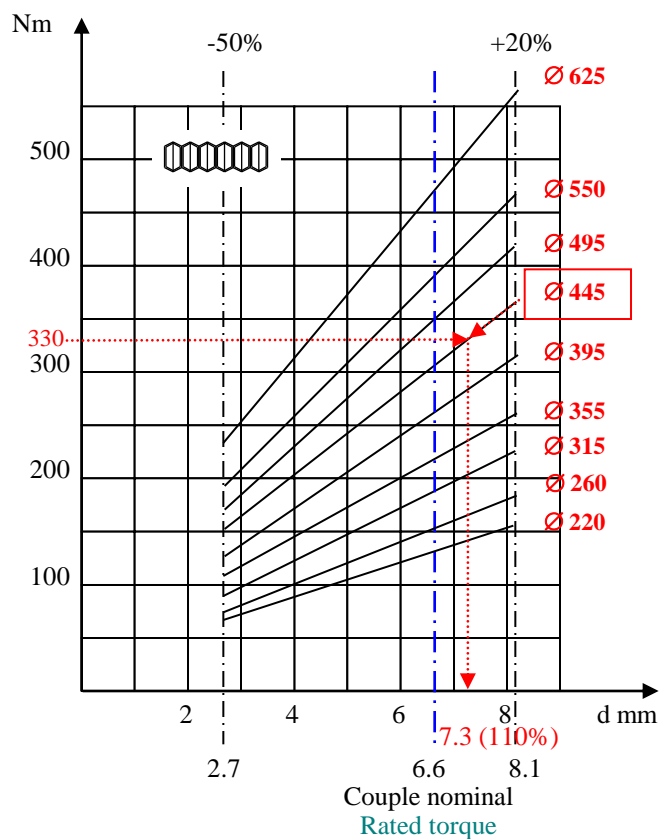
REGLAGE DU COUPLE DE FREINAGE BRAKING TORQUE ADJUSTMENT



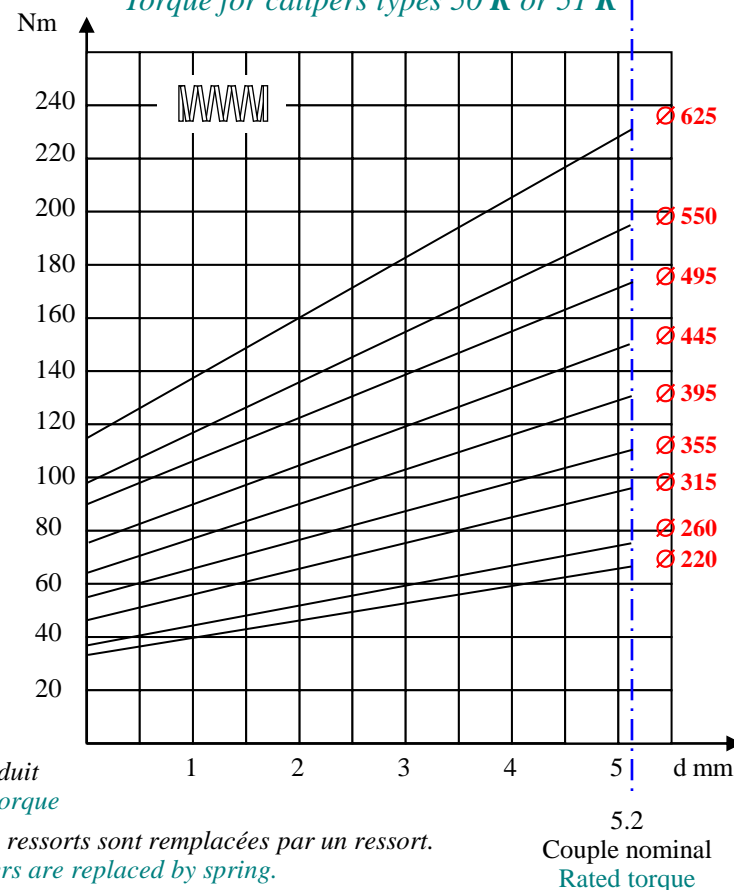
COUPLE DE FREINAGE

BRAKING TORQUE

Couple pour frein 50 ou 51 ou 52
Torque for calipers types 50 or 51 or 52



Couple pour frein 50 R ou 51 R
Torque for calipers types 50 R or 51 R

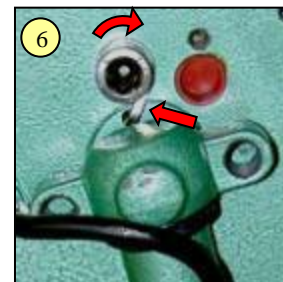


R : couple réduit
R : reduced torque

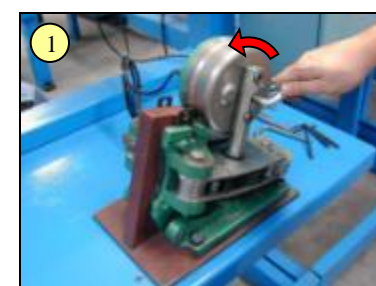
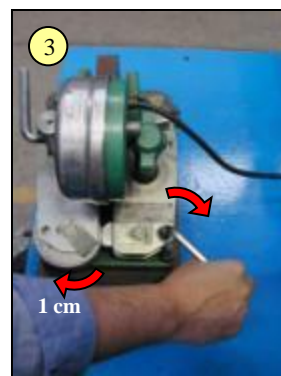
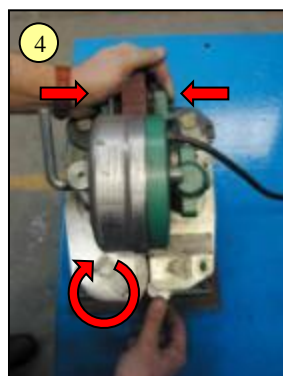
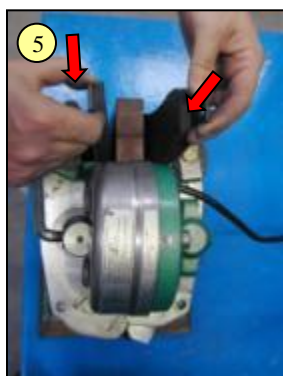
Les rondelles ressorts sont remplacées par un ressort.
Spring washers are replaced by spring.

REGLAGE DU COUPLE DE FREINAGE BRAKING TORQUE ADJUSTMENT

Resserrer la clef d'affalage et remettre l'ergot d'arrêt
Screw the manual release wrench and refit the retaining wires



Remettre les plaquettes / Refit the lining pads



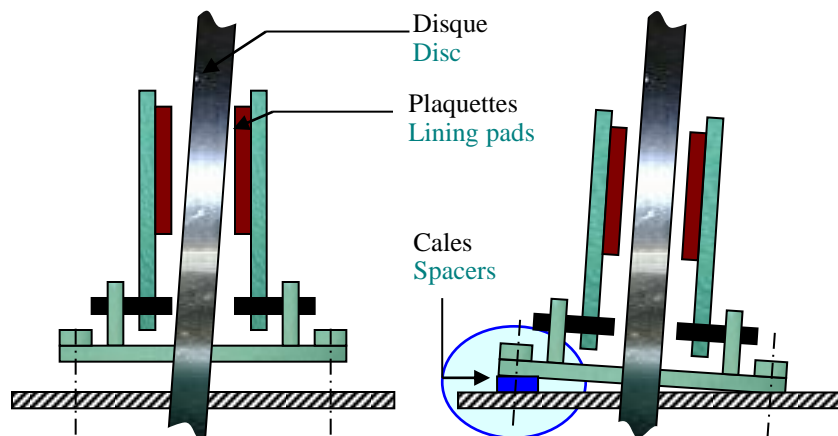
EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

PLAN DE POSE

PLANE OF ASSEMBLY

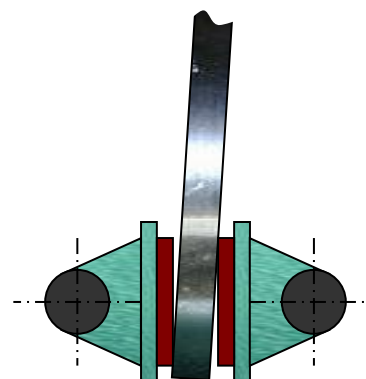
PLAN DE POSE

PLANE OF ASSEMBLY

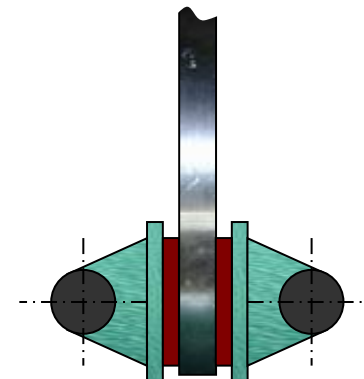


X MAUVAIS / WRONG:
Jeu non partagé.
Clearance not equally divided.

O BON / RIGHT:
Jeu partagé.
Clearance equally divided.

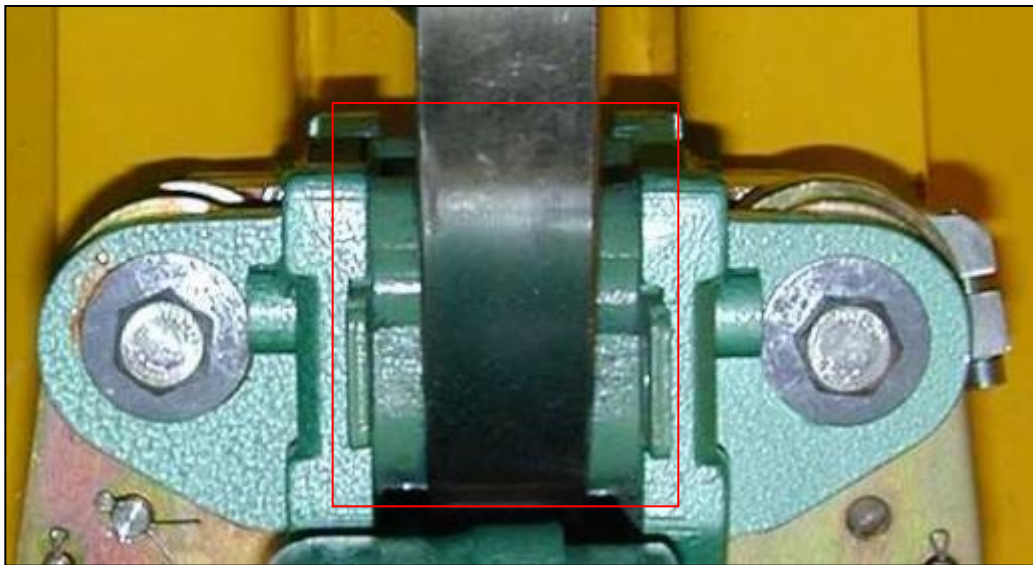


X MAUVAIS / WRONG :
Les plaquettes ne portent que sur un côté.
Pads bear on one edge only.



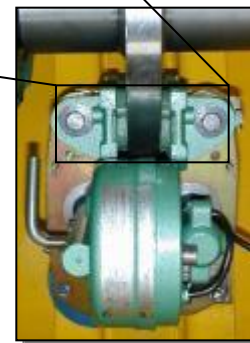
O BON / RIGHT :
Les plaquettes portent sur toute la surface.
Pads bear over whole area.

PLAN DE POSE PLANE OF ASSEMBLY

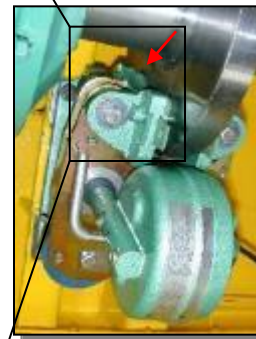
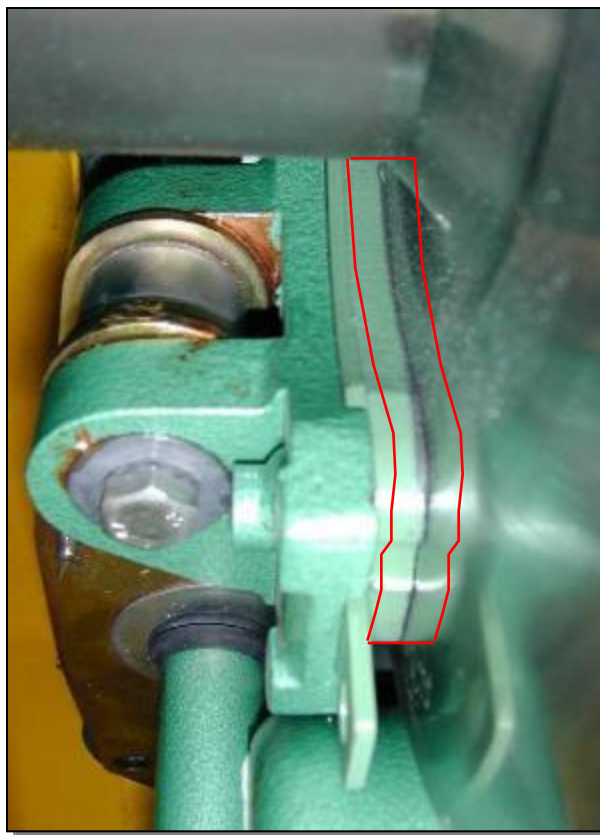


BON / RIGHT:
Les plaquettes portent sur toute la surface.

Pads bear over whole area.



PLAN DE POSE PLANE OF ASSEMBLY



BON / RIGHT:
Bonne surface de contact des
plaquettes sur le disque.

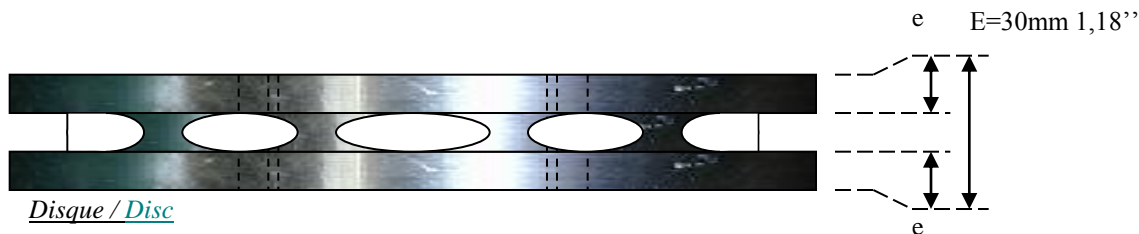
Good contact area between pads
and disk.

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

VERIFICATION DE L'USURE WEAR CHECKING

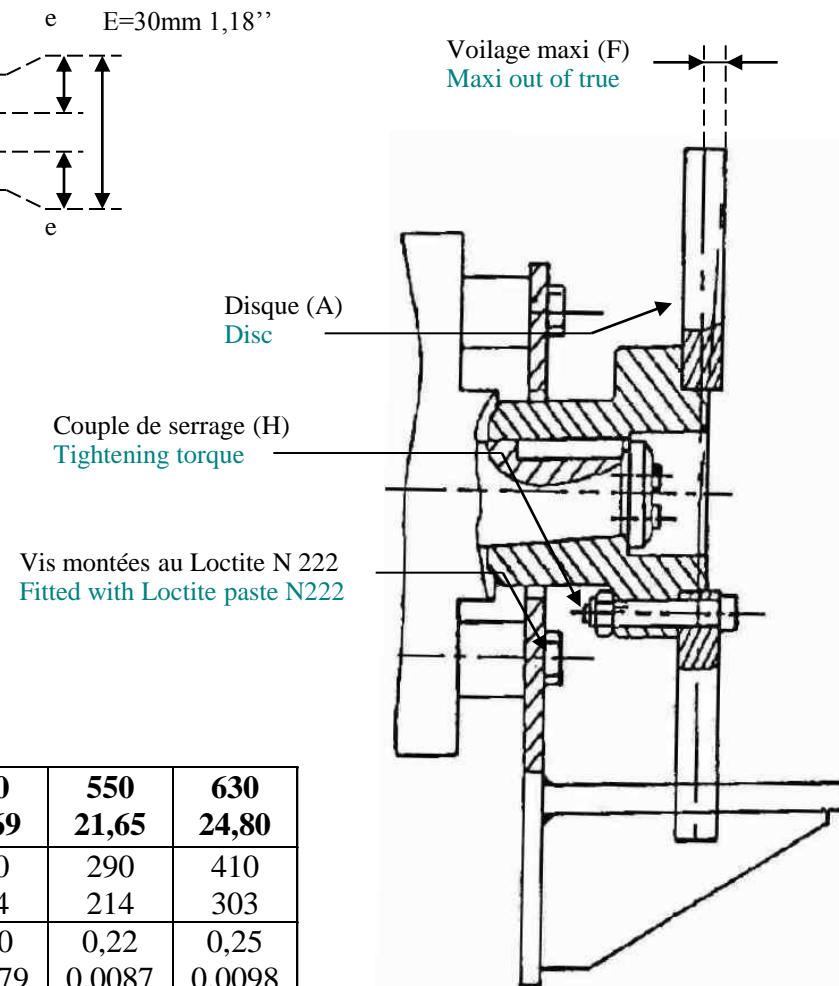
VERIFICATION DE L'USURE

WEAR CHECKING



Garniture de frein Lining pads	Mini 3 mm	0,1181 in
Disque (A) Disc		
Epaisseur (E) Thickness	Mini 28 mm	1,1024 in
Toile (e) Flange	Mini 7,5 mm	0,2953 in
Voilage disque (F) Out of true	< 0,08% of disc radius	
Fixation (H) Fixture	See table 1	

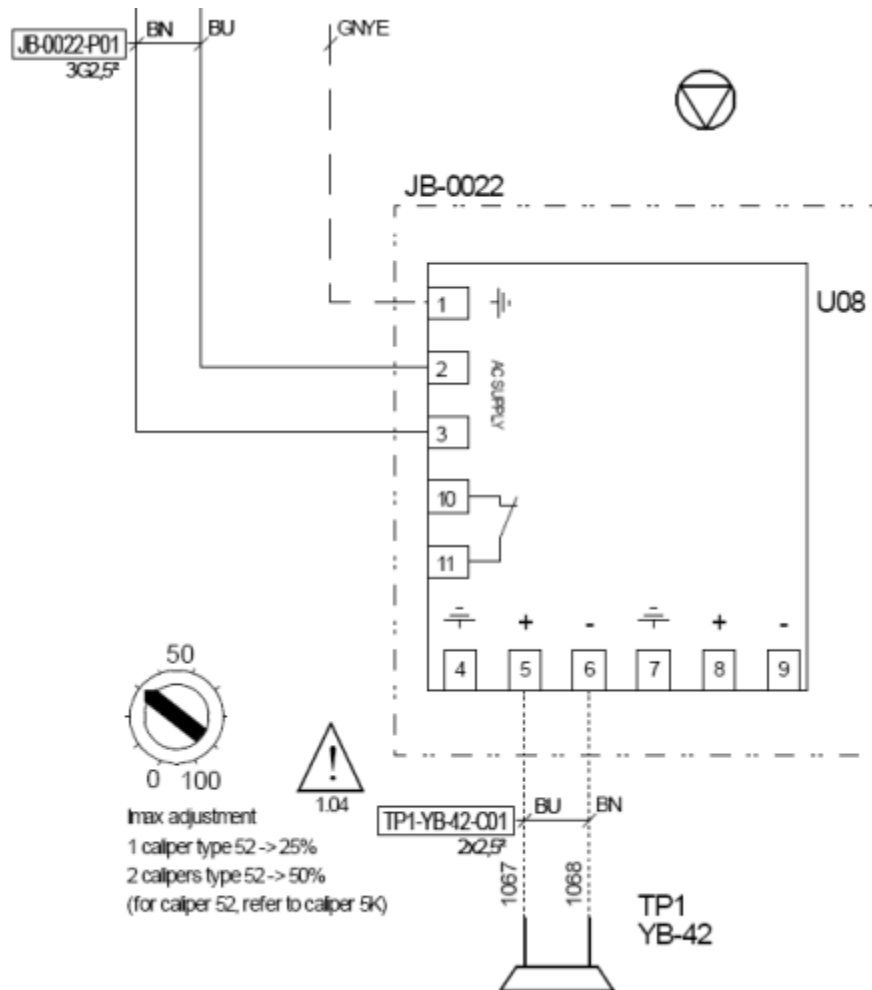
Ø disque Ø disc	(mm) (in.)	315 12,40	355 13,98	400 15,75	450 17,72	500 19,69	550 21,65	630 24,80
Couple de serrage Tightening torque	(N.m) (ft.lbs)	49 36	86 63	135 100	210 155	290 214	290 214	410 303
Voilage maxi Maxi out of true	(mm) (in.)	0,12 0,0047	0,14 0,0055	0,16 0,0063	0,18 0,0071	0,20 0,0079	0,22 0,0087	0,25 0,0098



EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

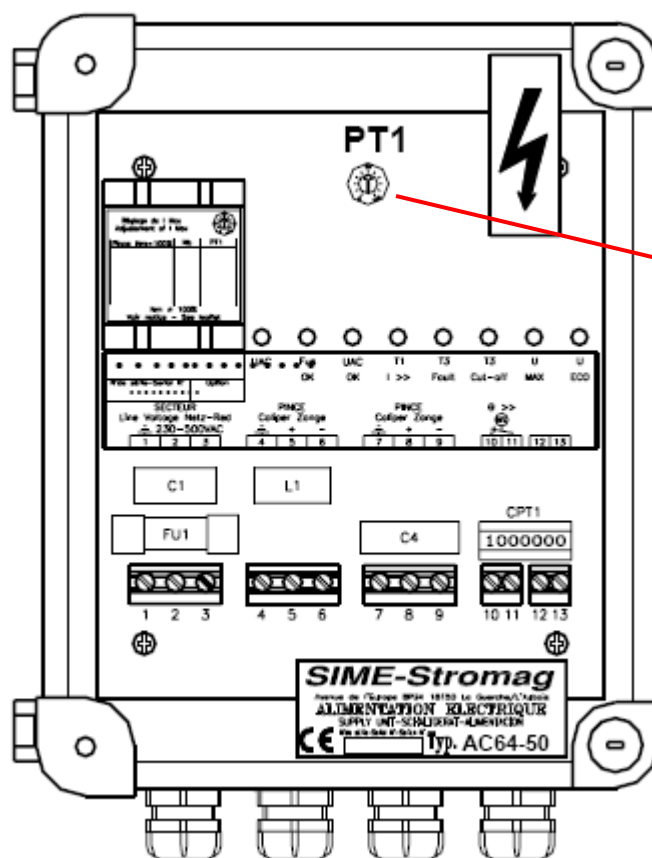
ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY

ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY

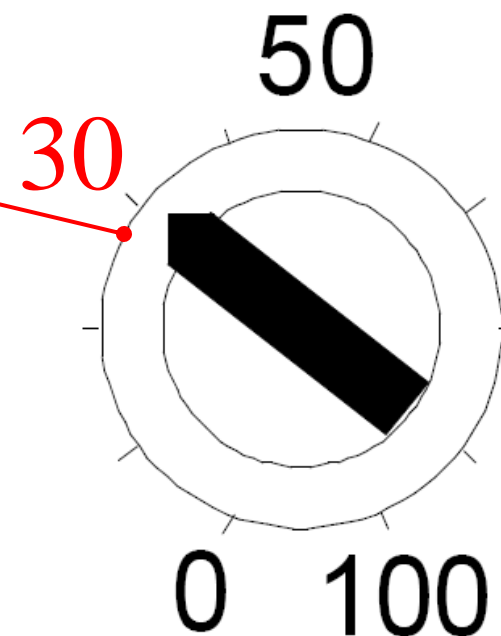


Power supply: AC64-50 CP

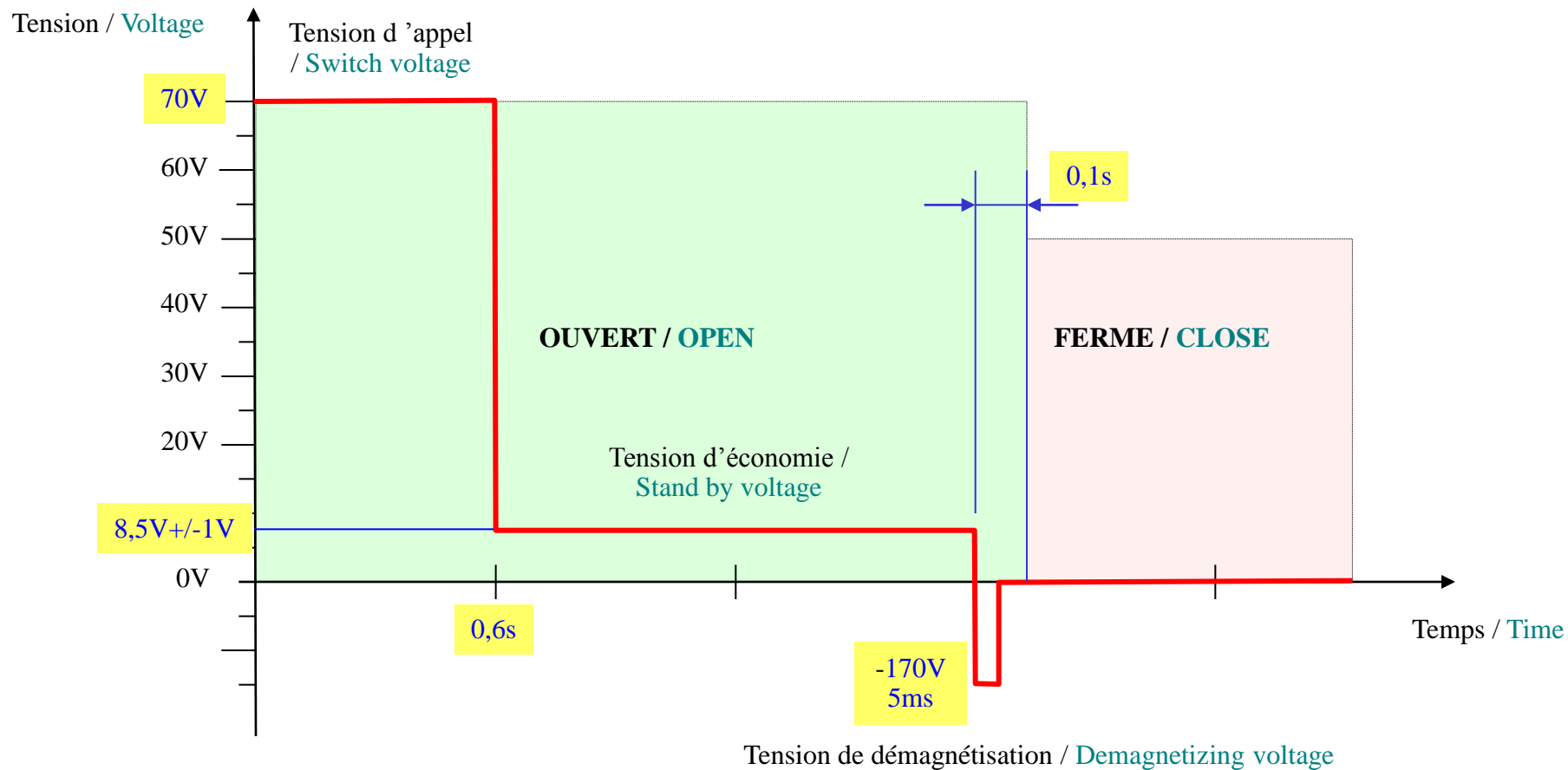
ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



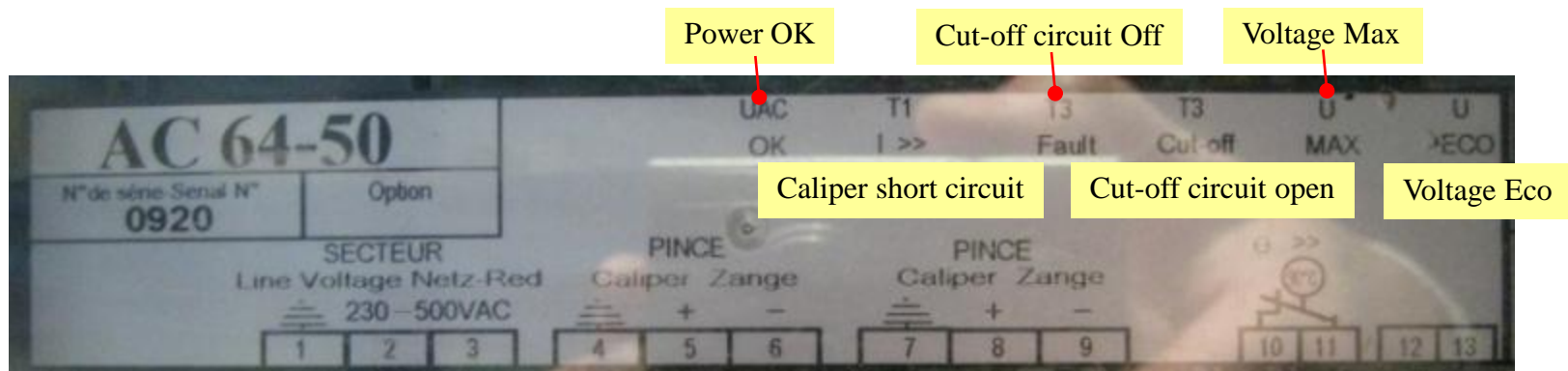
Potentiometer PT1



ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY

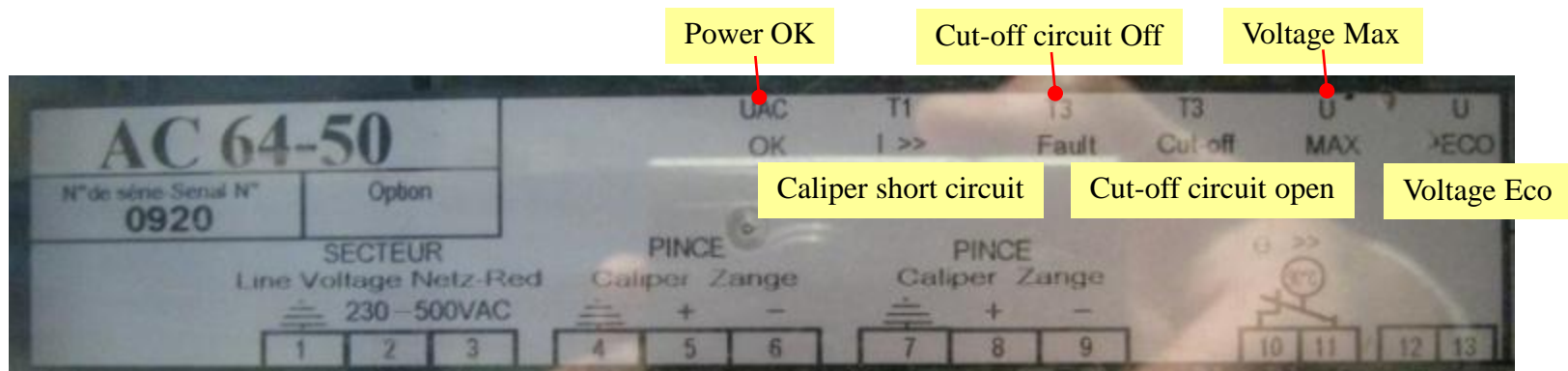


⊗ LED on	○ LED off
⊗ LED on during 20ms	

Lights	Function	Description
UAC	Mains current presence	Green LED on, in the presence of a mains voltage on terminals 2-3
FUS OK	Fuse OK	Green LED on, if fuse is OK
UAC OK	Current mains OK	Green LED on, if the mains voltage is correct on terminals 2-3
T1 I>>	Short circuit caliper	Red LED on, in case of short circuit on caliper output
T3 Fault	Cut-off circuit Fault	Red LED on, if cut-off circuit is on short circuit
T3 Cut-off	Cut-off circuit active	Red LED on, if cut-off circuit is opened
U MAX	Current MAX	Yellow LED on, in the presence of Max current (opening of the brakes)
U ECO	Current ECO	Green LED on, in the presence of economy voltage (keeping up brakes opened)

ALIMENTATION ELECTRIQUE

ELECTRICAL POWER SUPPLY

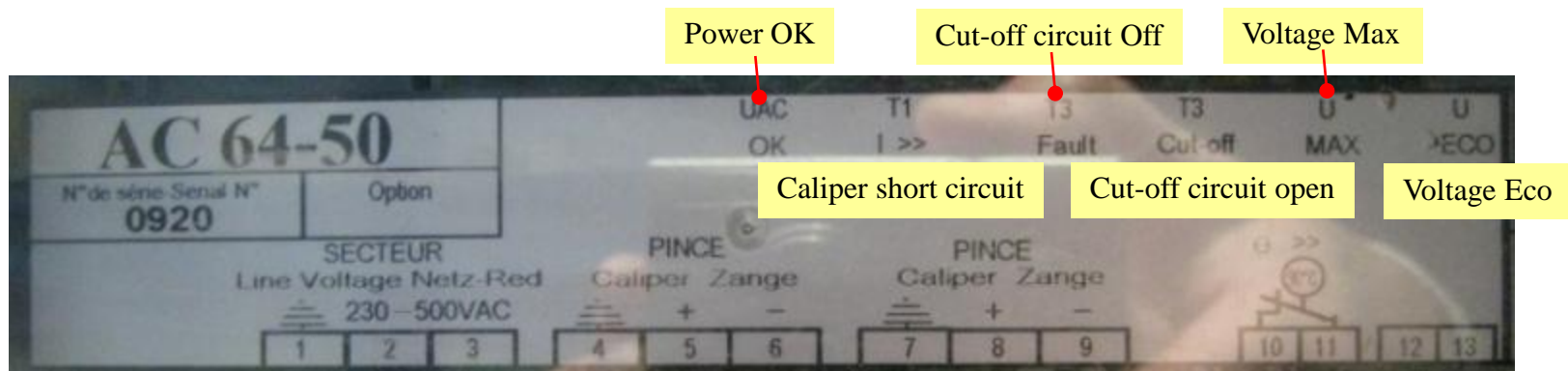


⊗ LED on	○ LED off
⊗ LED on during 20ms	

Normal cycle of brake opening /closing

UAC	FUS OK	UAC OK	T1 I>>	T3 Fault	T3 Cut off	U MAX	U ECO	OPERATING STATE
⊗	⊗	⊗	○	○	⊗ 20ms	○	○	Cut-off current opened during 20ms at energizing
⊗	⊗	⊗	○	○	○	⊗ 0.6s	○	Current Max active for callipers opening (0.6s max)
⊗	⊗	⊗	○	○	○	○	⊗	Current ECO active for keeping up callipers opened
○	○	○	○	○	⊗ 0.5s	○	○	Cut-off circuit opened for the fast closing of callipers (LED on to 0.2 at 1s)

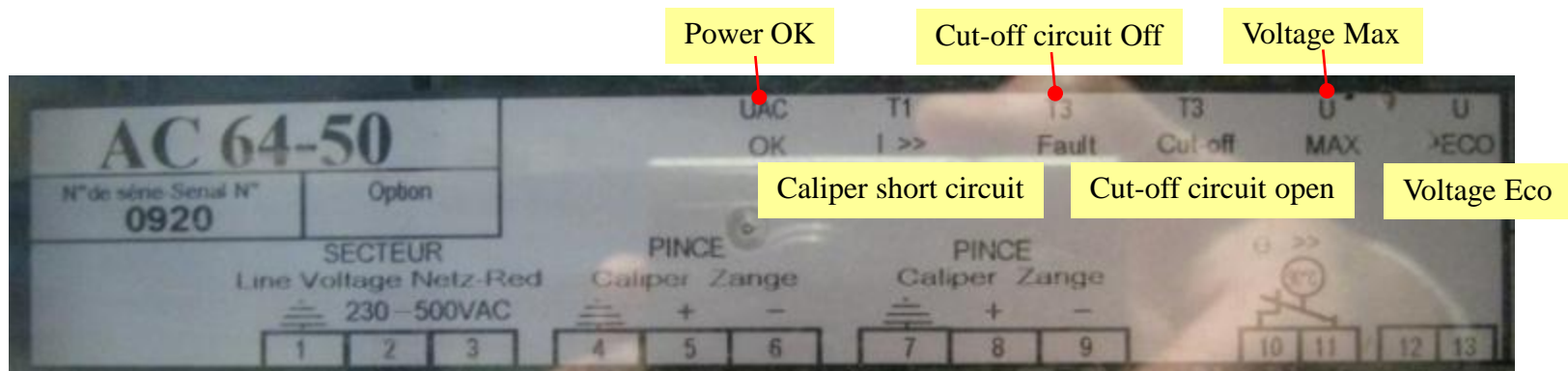
ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



Operating fault

UAC	FUS OK	UAC OK	T1 I >>	T3 Fault	T3 Cut off	U MAX	U ECO	DETECTED FAULT	ACTION
⊗	⊗	○	○	○	⊗	○	○	Mains voltage too low	Check the mains
⊗	⊗	⊗	○	○	○	○	○	Potentiometer PT1 on 0%	Adjust the potentiometer PT1 following the type and number of caliper
⊗	⊗	⊗	⊗	○	○	○	○	Cut-off on caliper output	Check the wiring of the caliper output
⊗	⊗	⊗	○	⊗	○	○	○	Cut-off circuit in short circuit	Return power supply OS at Stromag France
⊗	⊗	⊗	○	○	⊗	○	○	Cut-off circuit crossed	Return power supply OS at Stromag France
⊗	⊗	⊗	○	○	○	⊗	○	- Absence of the caliper - Power supply blocked in voltage MAX	- Check the wiring of the caliper - Return power supply OS at Stromag France
⊗	○	○	○	○	○	○	○	Fuse FU1 OS	Replace the fuse and check the correct operation of power supply

ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



Operating fault of the brake

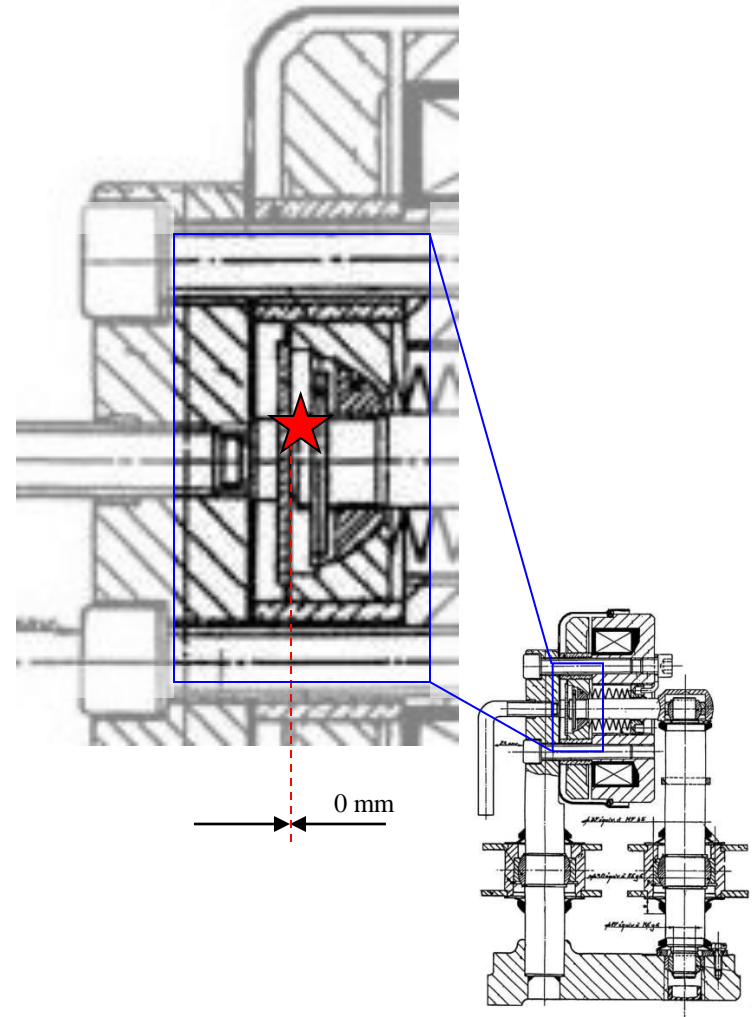
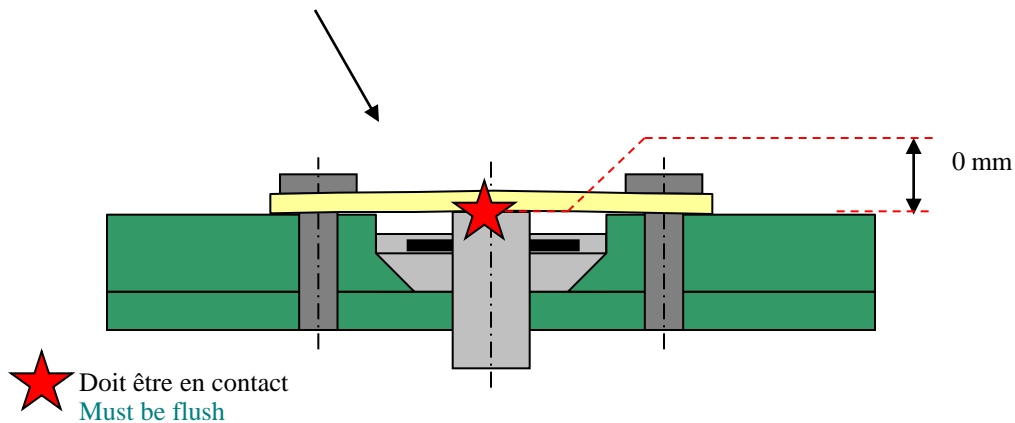
Detected faults	Check
No caliper opening when energizing	The PT1 setting - The caliper air gap - The MAX voltage- The wiring of opening switch-The mains presence
Closing of the caliper during economy voltage	The ECO voltage- The wiring of opening switch -The mains control- The possible fouling of caliper air gap
Slow closing of the caliper	The caliper voltage at mains cut-off - The setting of caliper torque - Mains control - power supply type (R option)

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

AJUSTEMENT DE L' ECROU SPHERIQUE SPHERICAL NUT ADJUSTMENT

AJUSTEMENT DE L'ECROU SPHERIQUE

SPHERICAL NUT ADJUSTMENT





<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

**THANK YOU FOR YOUR
ATTENTION**

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MA'ADEN PROJECT

P1034 - PTM

POT TENDING MACHINE

AIR CONDITIONING

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

NOTIONS

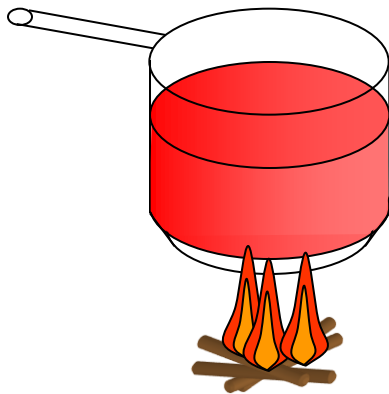
NOTIONS

FLUID CHARACTERISTICS

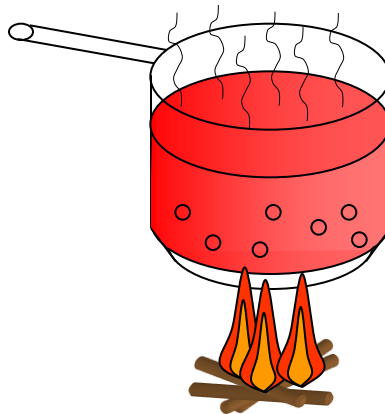
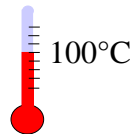
A pure fluid evaporates at constant temperature.

for example, if we consider water at normal atmospheric pressure ...

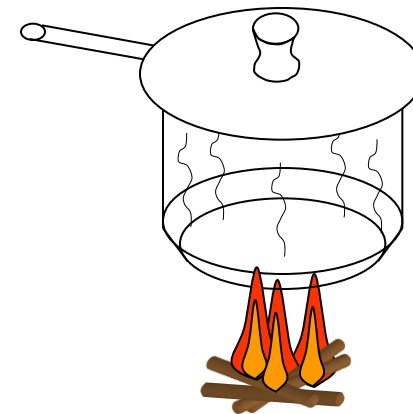
Water warms, temperature may be
between room temperature and
100°C



Water evaporates, temperature is 100°C at boiling point



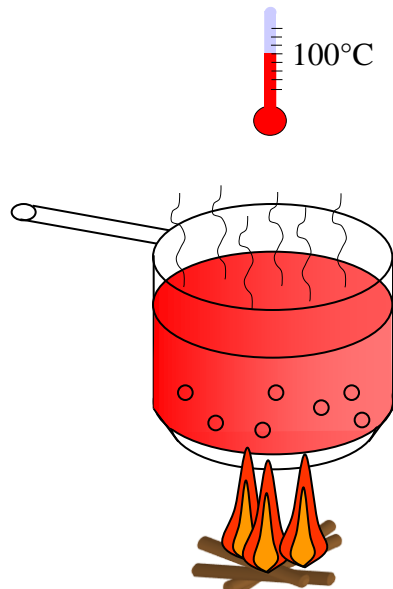
There is no more liquid water,
water vapor is more than 100°C



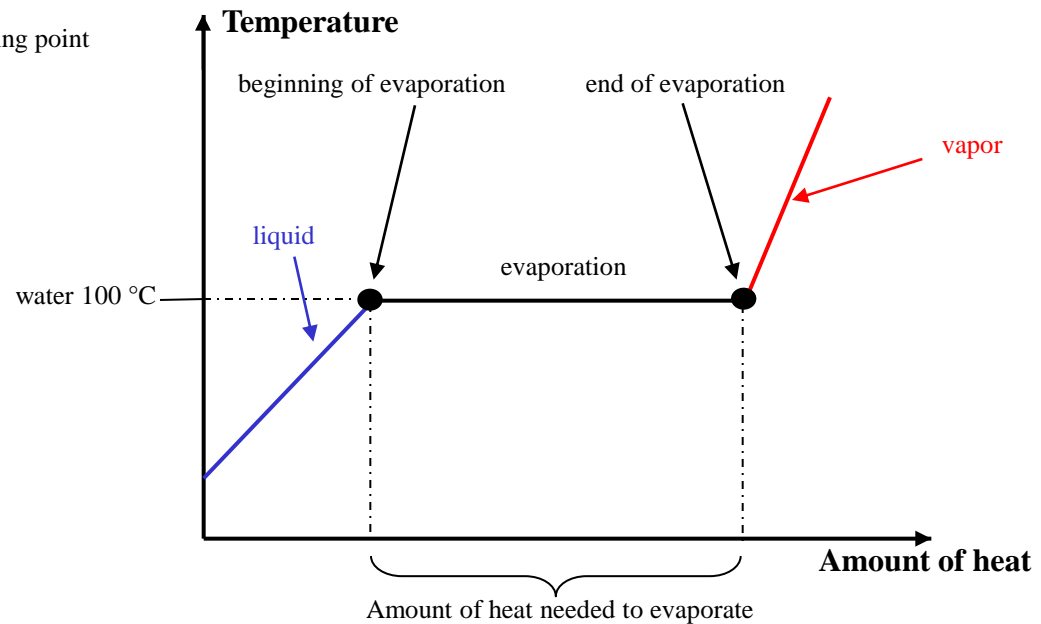
TEMPERATURE CHANGES

A pure fluid evaporates at constant temperature.

Water evaporates, temperature is 100°C at boiling point

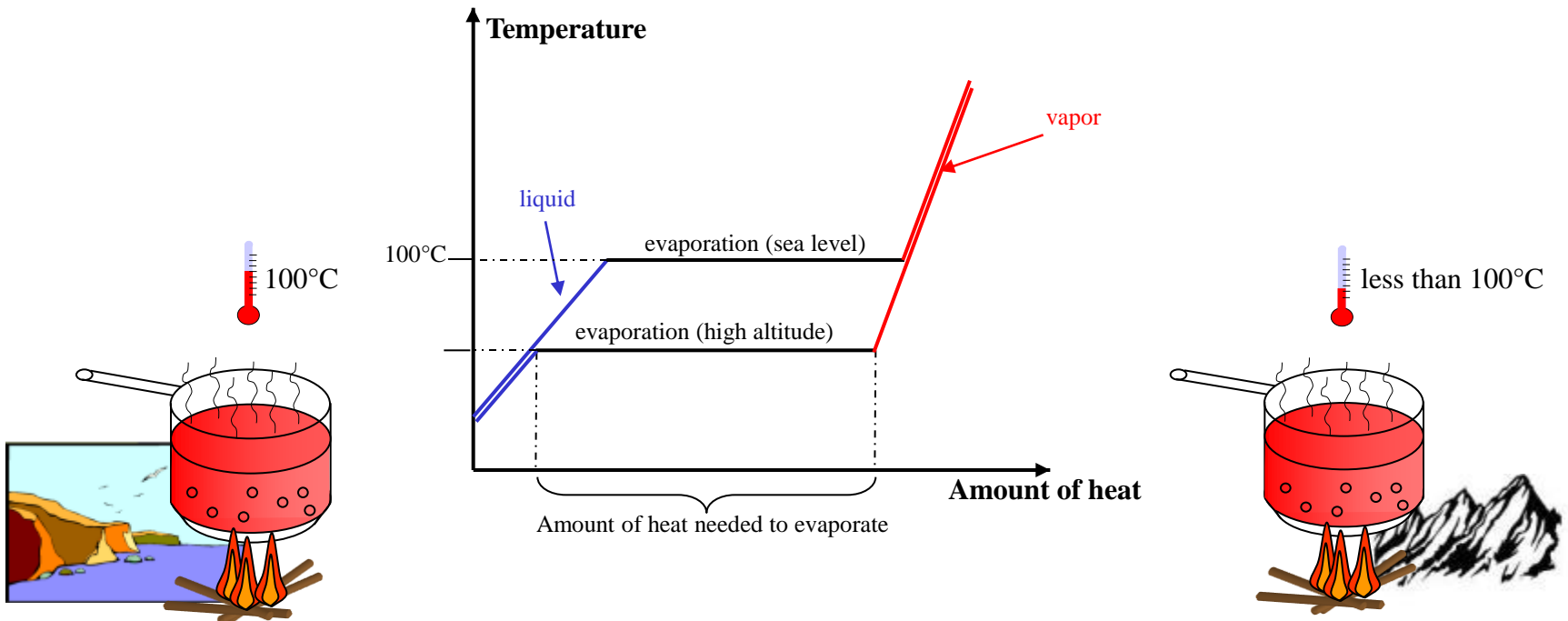


Amount of heat needed to evaporate



FLUID CHARACTERISTICS

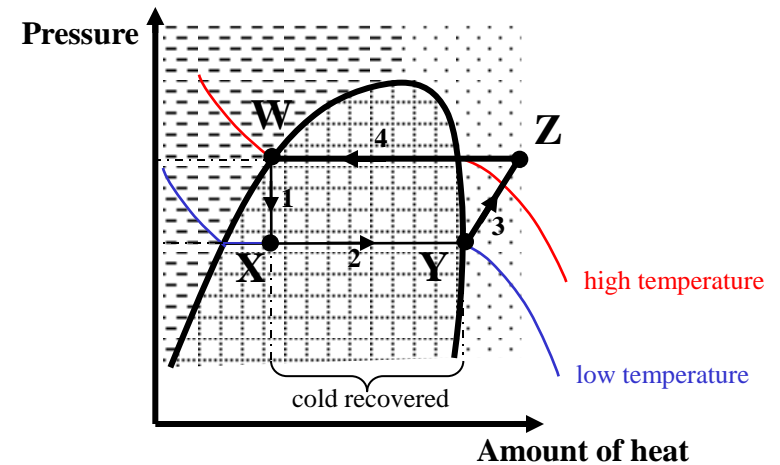
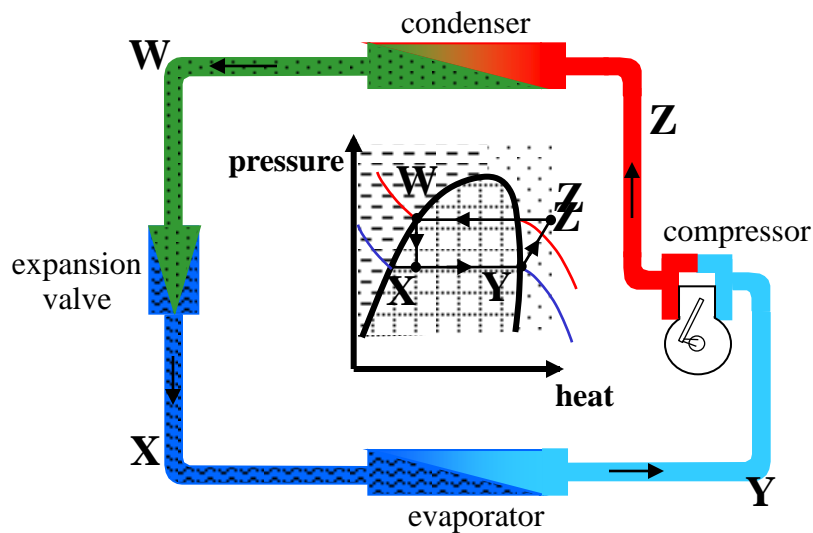
The evaporation temperature decreases if the pressure decreases.



The evaporating temperature of a pure fluid is known if one knows the pressure.

HOW TO PRODUCE CONTINUOUS COLD ?

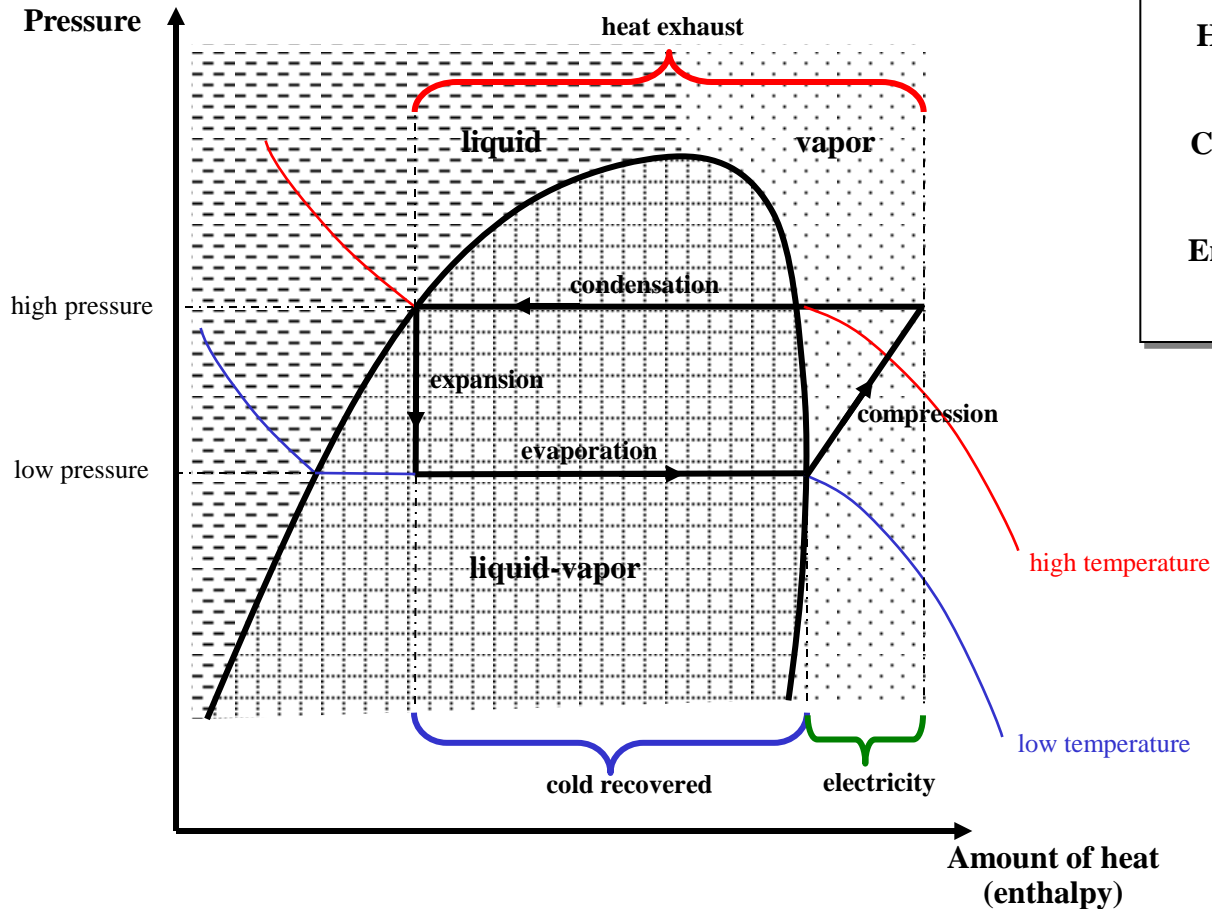
For a continuous operation, we need the cold evaporated fluid putting in the initial receiver as a high pressure liquid.



Cold production in 4 steps:

- 1 – expansion of the high pressure liquid (W-X)
- 2 – evaporation of the low pressure liquid (X-Y)
(cold recovering)
- 3 – vapor compression (Y-Z)
- 4 – condensation of the high pressure vapor (Z-W)

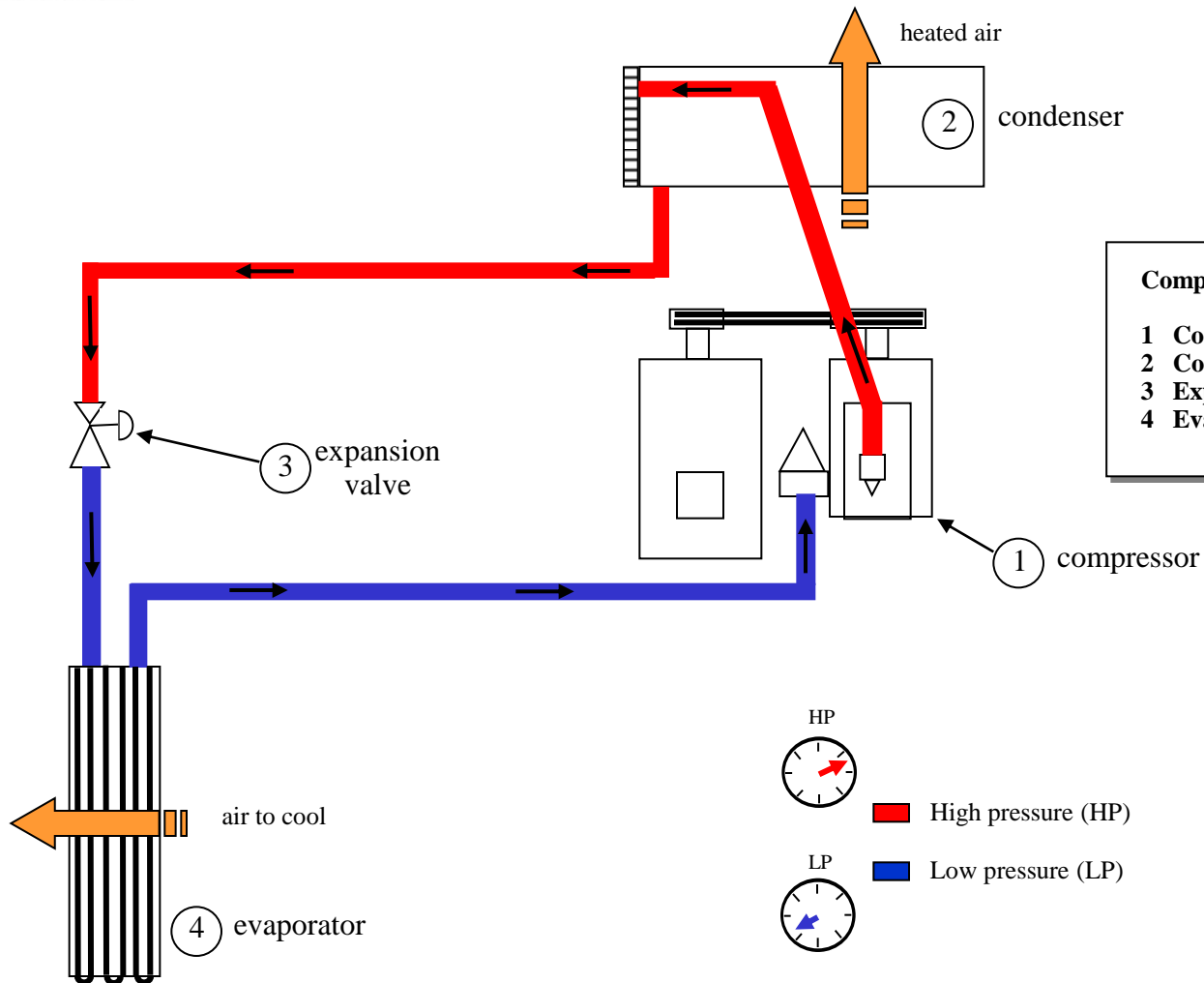
COLD PRODUCTION - HEAT PRODUCTION



Heat production on the condenser
=
Cold production on the evaporator
+
Energy supplied by the compressor
(electricity)

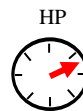
A cooler produces more heat
than cold

ESSENTIAL COMPONENTS OF A REFRIGERATING CIRCUIT



Components necessary and sufficient:

- 1 Compressor
- 2 Condenser
- 3 Expansion valve
- 4 Evaporator

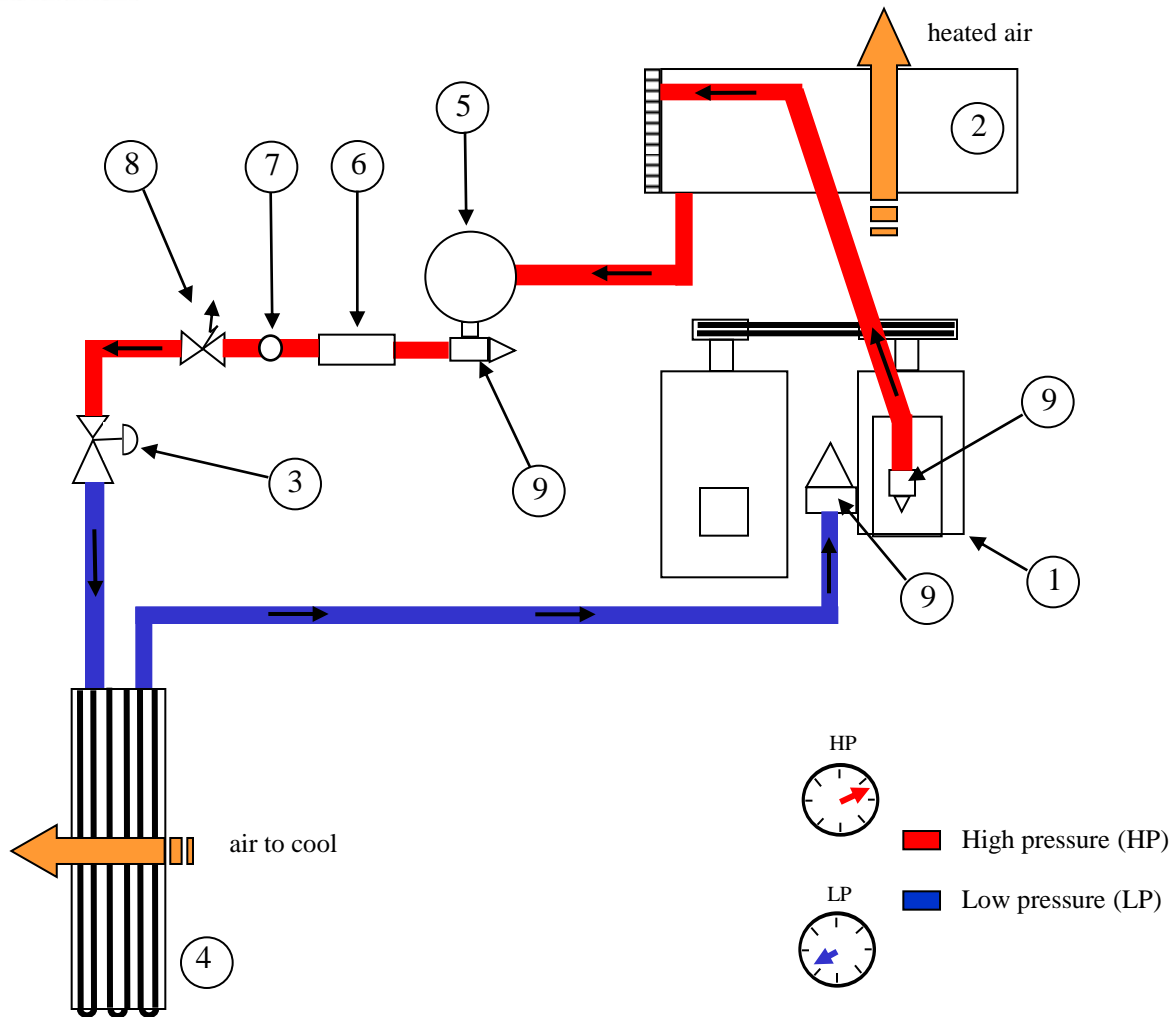


High pressure (HP)



Low pressure (LP)

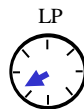
ESSENTIAL COMPONENTS OF A REFRIGERATING CIRCUIT



- 1 Compressor
- 2 Condenser
- 3 Expansion valve
- 4 Evaporator
- 5 Liquid receiver
- 6 Filter-dehydrator
- 7 Sight glass
- 8 Solenoid valve
- 9 Insulating valves



High pressure (HP)



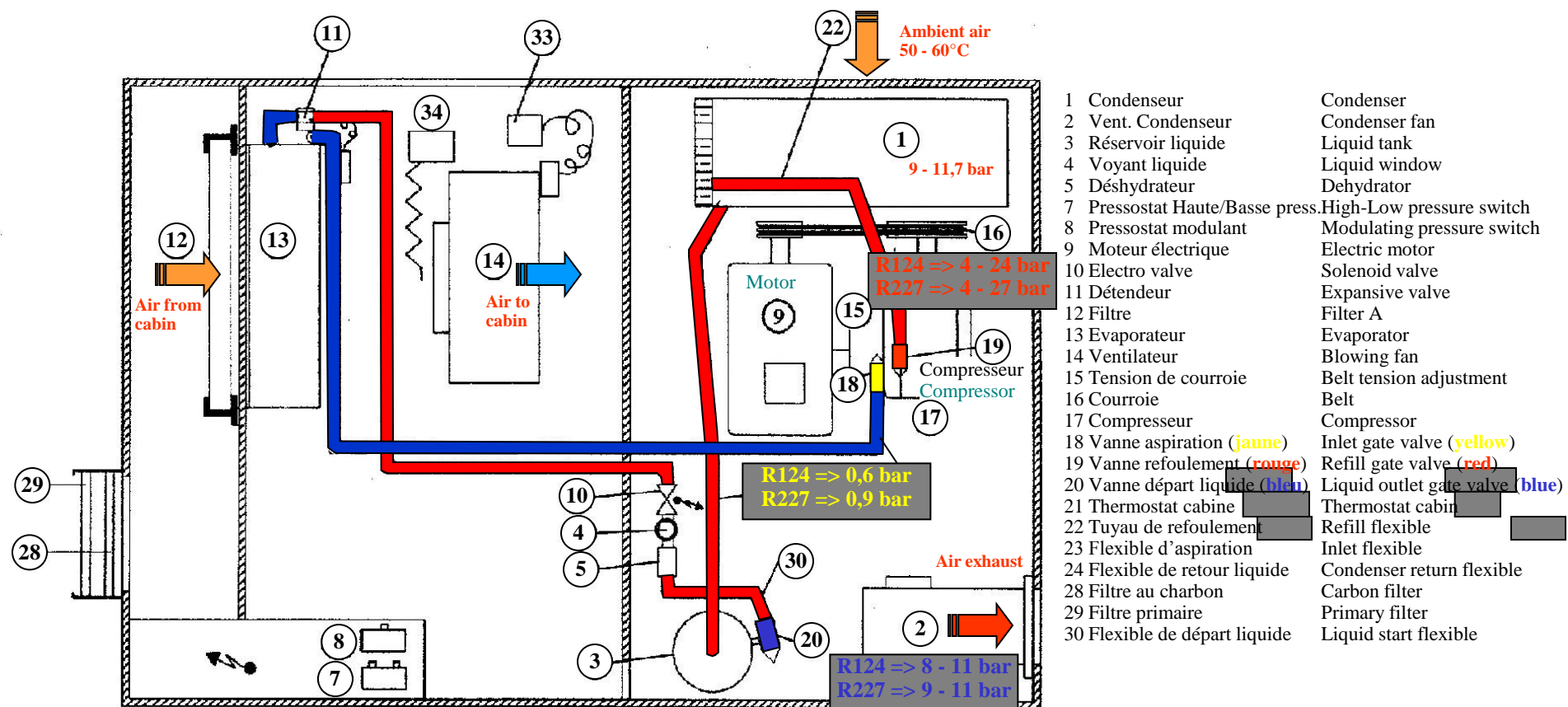
Low pressure (LP)

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

PRINCIPE **PRINCIPLE**




HAUTE / BASSE PRESSION HIGH / LOW PRESSURE

■ Haute pression (HP) / High Pressure (HP)
■ Basse pression (BP) / Low Pressure (LP)



PHASE GAZEUSE-LIQUIDE

GASEOUS-LIQUID PHASE

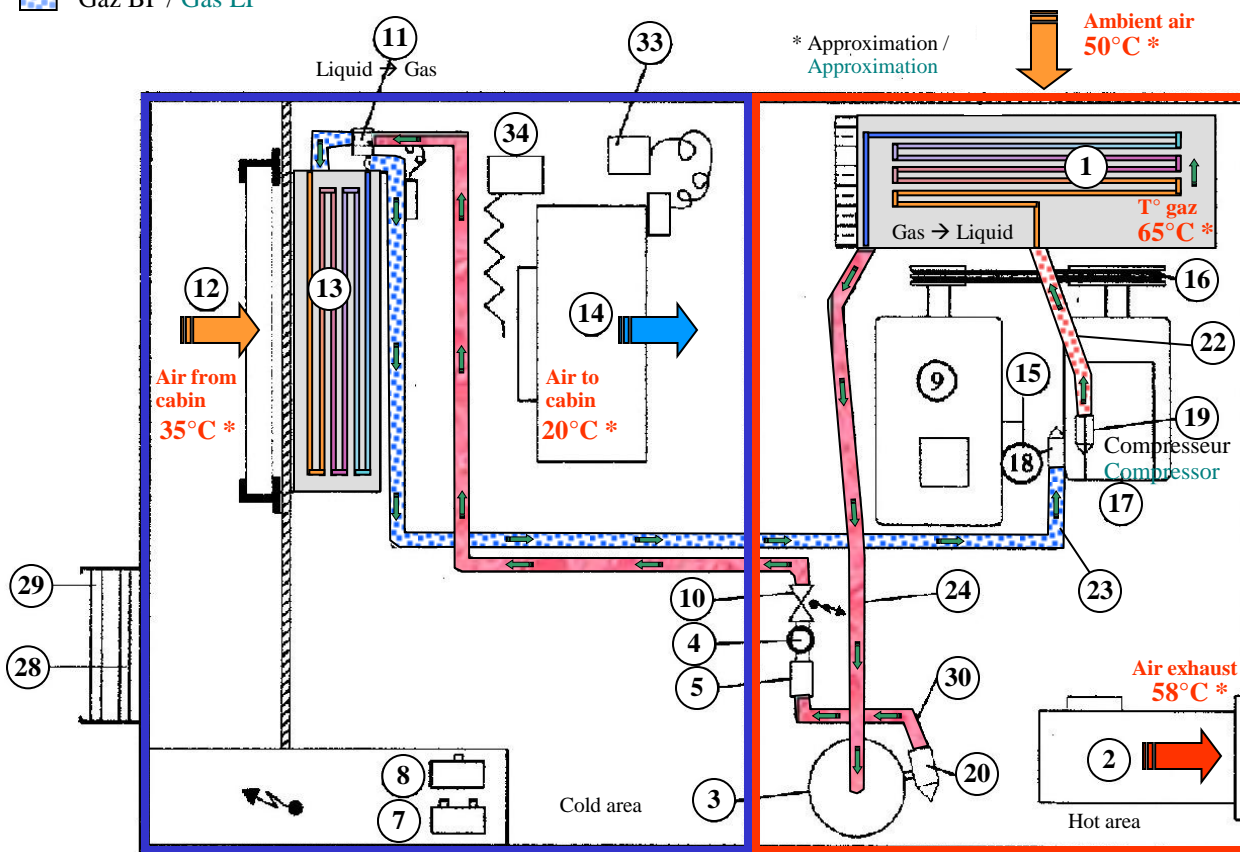
-  Liquide HP / Liquid HP
-  Gaz HP / Gas HP
-  Gaz BP / Gas LP

GAZ / LIQUIDE

GAS / LIQUID

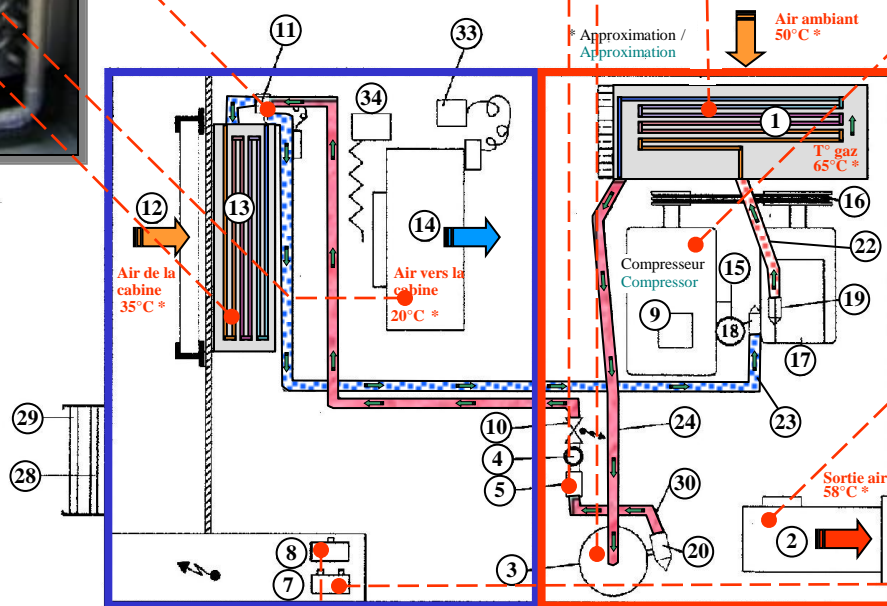
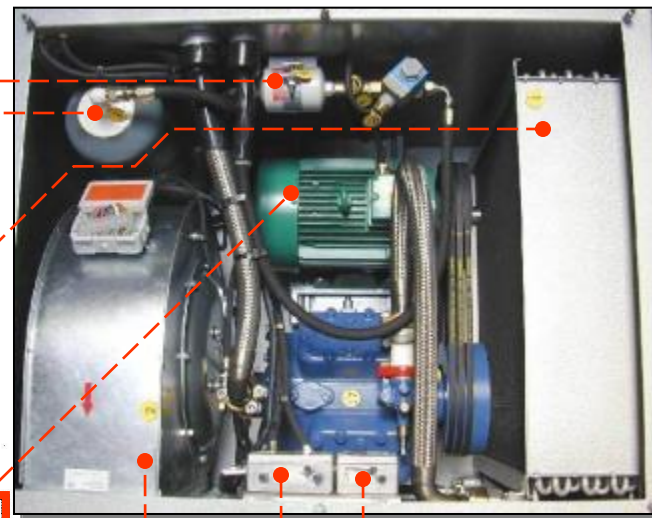
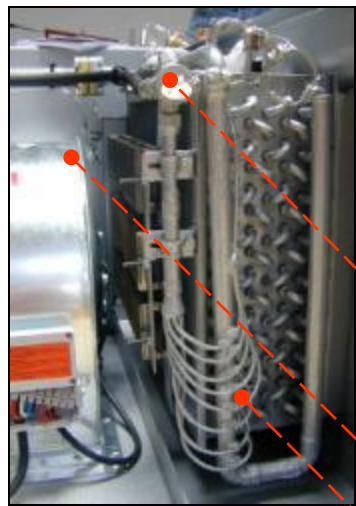
* Approximation /
Approximation

Ambient air
50°C *



- | | |
|---------------------------------|---------------------------------|
| 1 Condenseur | Condenser |
| 2 Vent. Condenseur | Condenser fan |
| 3 Réservoir liquide | Liquid tank |
| 4 Voyant liquide | Liquid window |
| 5 Déshydrateur | Dehydrator |
| 7 Pressostat Haute/Basse press. | High-Low pressure switch |
| 8 Pressostat modulant | Modulating pressure switch |
| 9 Moteur électrique | Electric motor |
| 10 Electro valve | Solenoid valve |
| 11 Détendeur | Expansive valve |
| 12 Filtre | Filter A |
| 13 Evaporateur | Evaporator |
| 14 Ventilateur | Blowing fan |
| 15 Tension de courroie | Belt tension adjustment |
| 16 Courroie | Belt |
| 17 Compresseur | Compressor |
| 18 Vanne aspiration (jaune) | Inlet gate valve (yellow) |
| 19 Vanne refoulement (rouge) | Refill gate valve (red) |
| 20 Vanne départ liquide (bleu) | Liquid outlet gate valve (blue) |
| 21 Thermostat cabine | Thermostat cabin |
| 22 Tuyau de refoulement | Refill flexible |
| 23 Flexible d'aspiration | Inlet flexible |
| 24 Flexible de retour liquide | Condenser return flexible |
| 28 Filtre au charbon | Carbon filter |
| 29 Filtre primaire | Primary filter |
| 30 Flexible de départ liquide | Liquid start flexible |

VUE GENERALE GENERAL VIEW



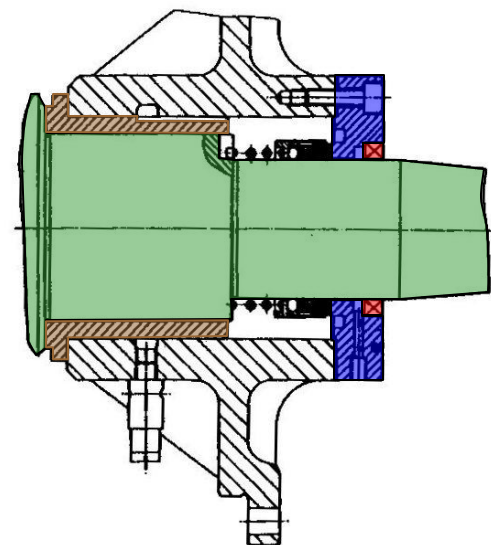
COMPRESSEUR COMPRESSOR



IMPORTANT :

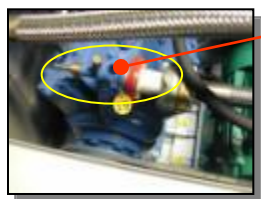
Huile à utiliser avec un compresseur **BOCK**
Oil to be used with **BOCK** compressor:
R227 and R134a » FUCHS SE 55

Compresseur / Compressor			Poulie / Pulley	
Type	Cyl.	Huile (litre)	Vitesse (tr/mn)	Nb de gorges / Nb of grooves
F3	2	1,5	1800↔960	2
F4	4	2,6	1800↔500	3
F5	4	3,8	1800↔500	4

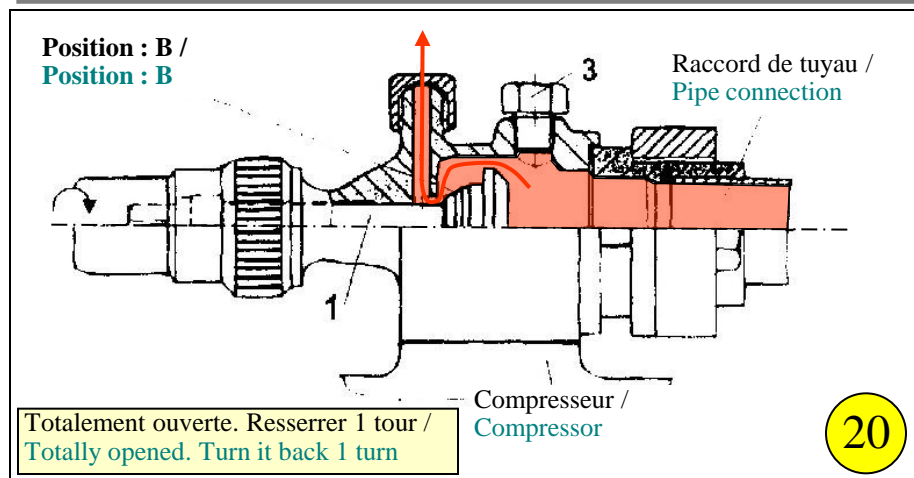
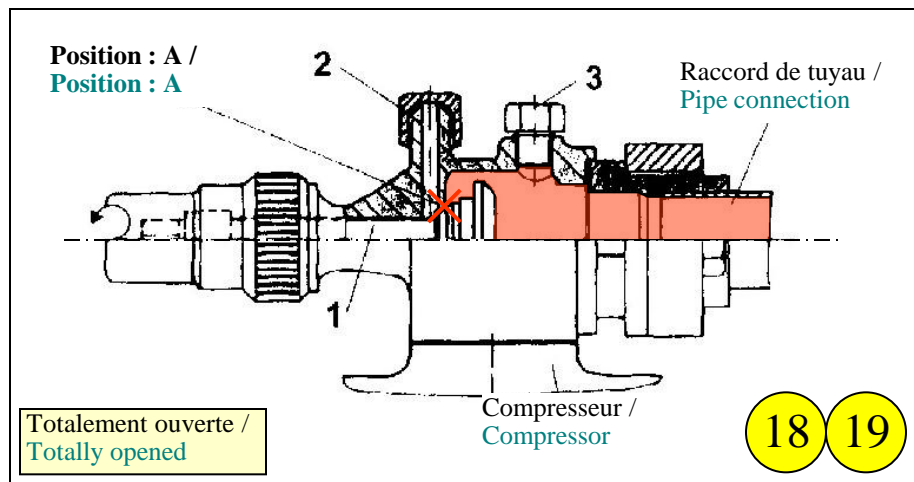
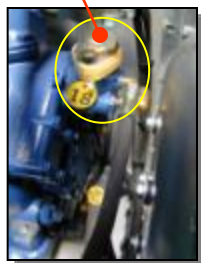
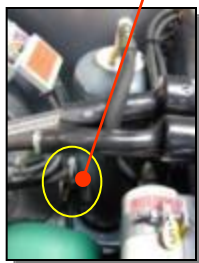


Etanchéité au gaz / Gas tightness

VANNE-ROBINET GAS GATE VALVE

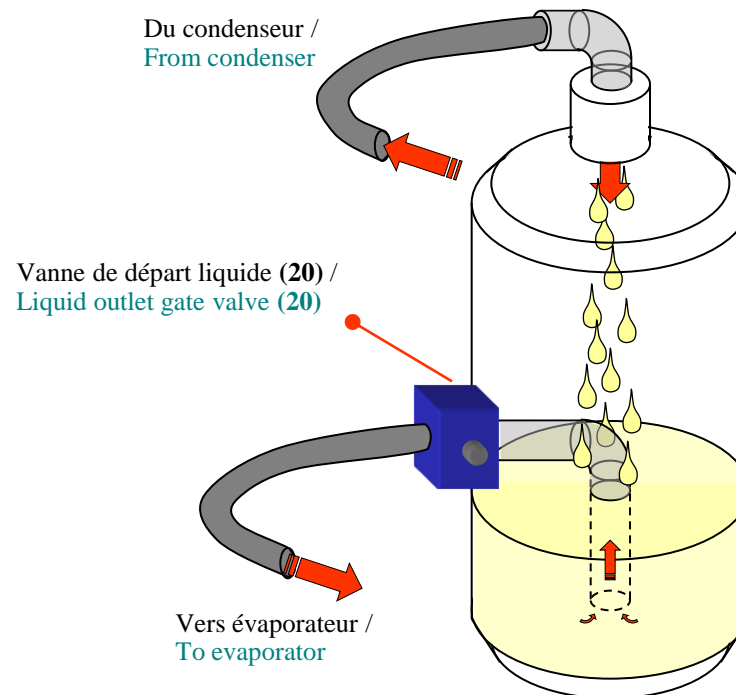


Vanne-robinet / Gas gate valve



RESERVOIR LIQUIDE LIQUID TANK

3



CARTOUCHE DESHYDRATANTE

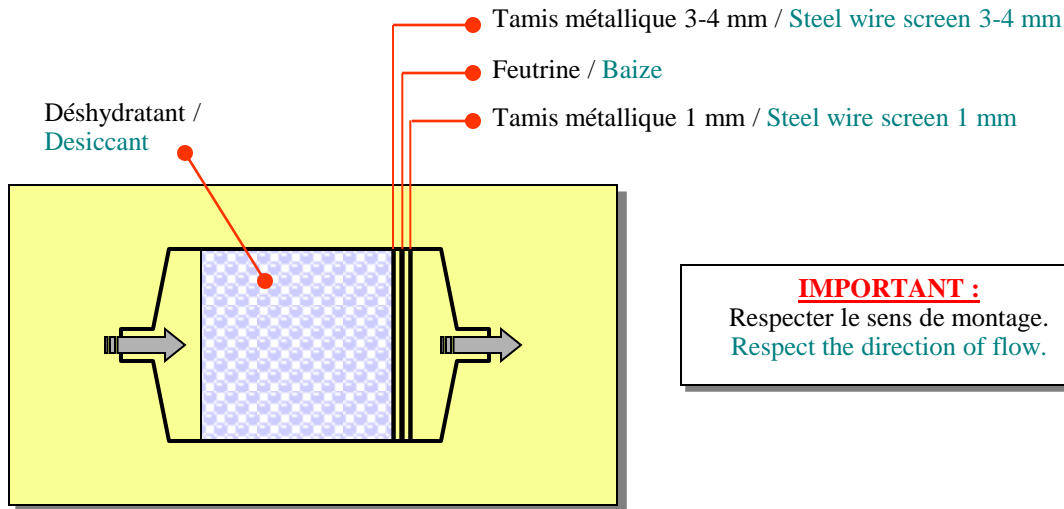
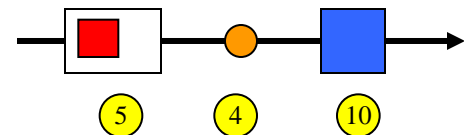
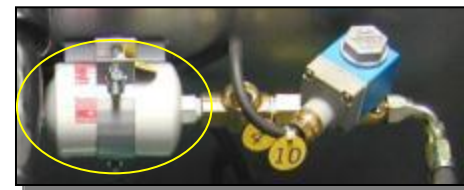
DEHYDRATOR CARTRIDGE

5



Déshydrateur / Dehydrator

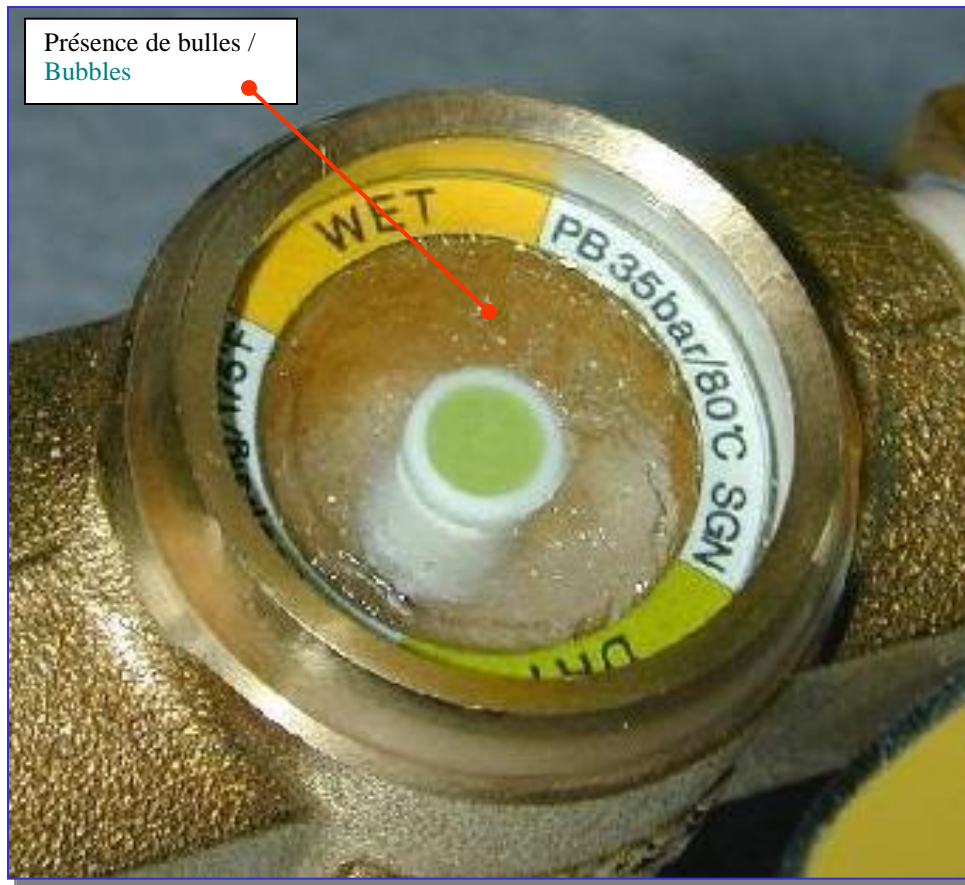
Ce filtre doit être changé chaque fois qu'une partie du circuit est mise à l'atmosphère.
This filter has to be changed each time a part of the circuit has been exposed to ambient air.



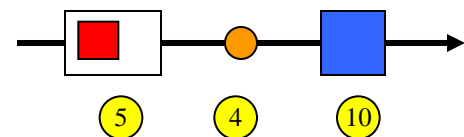
IMPORTANT :
Respecter le sens de montage.
Respect the direction of flow.

VOYANT DE CHARGE LIQUID FILLING WINDOW

Présence de bulles /
Bubbles



La charge n'est pas correcte / The filling is not correct

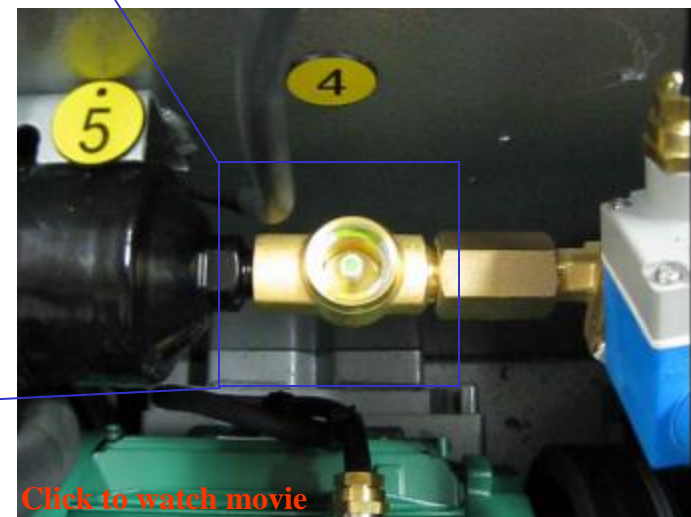


L'effet de bullage peut apparaître si:

- La charge est incorrecte
- Manque de débit d'air à l'évaporateur /

The bubbling phenomena may appears if:

- The filling is not correct
- The flow of air through the evaporator is too low



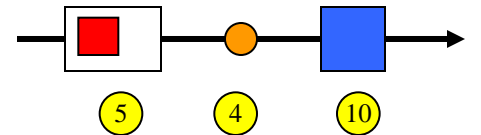
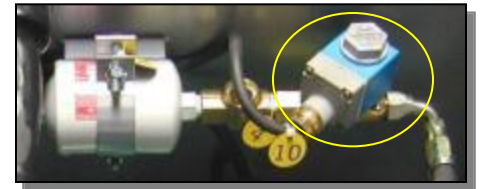
[Click to watch movie](#)

ELECTROVANNE SOLENOID VALVE

10

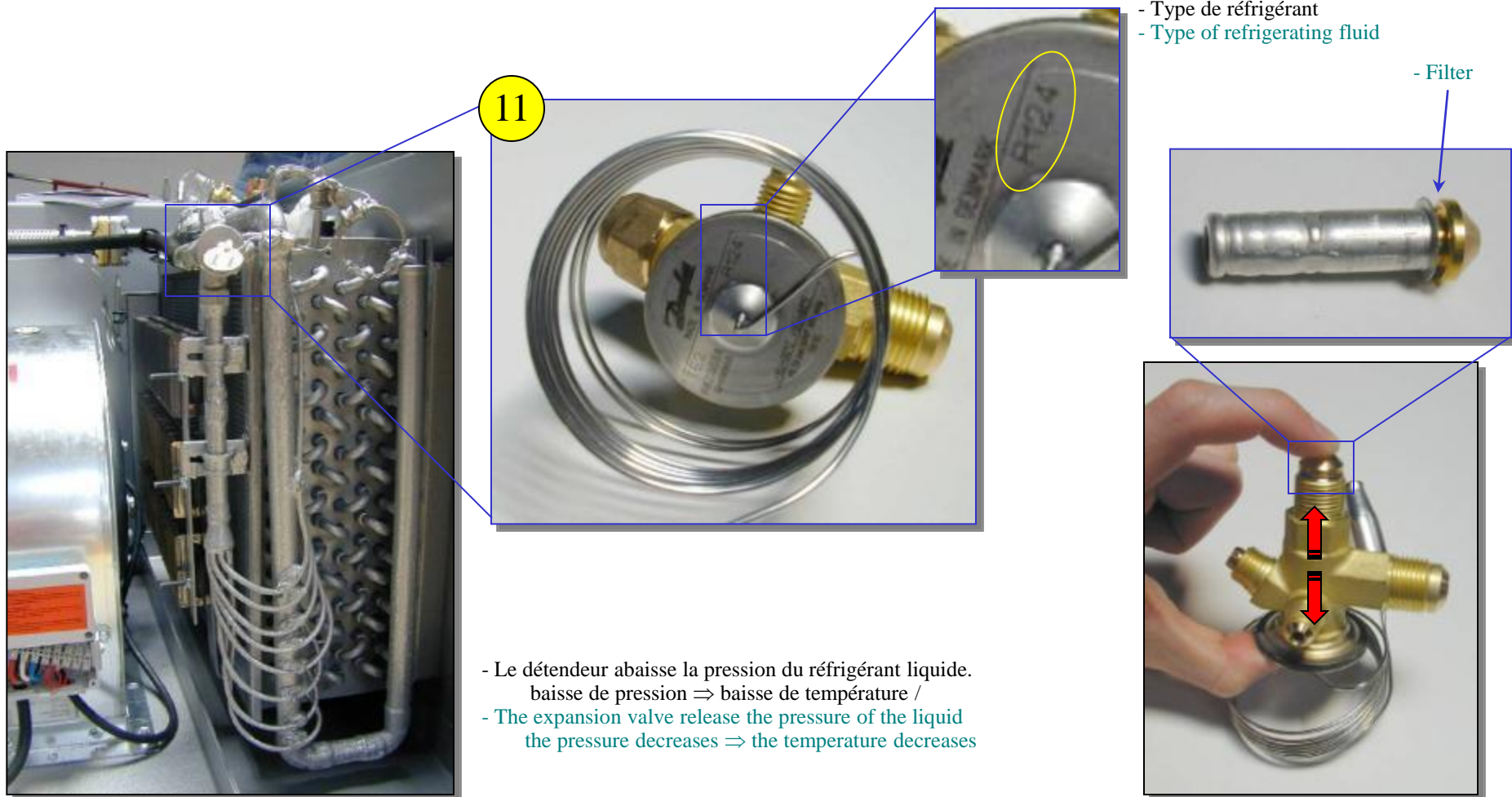


Electrovanne / Solenoid valve

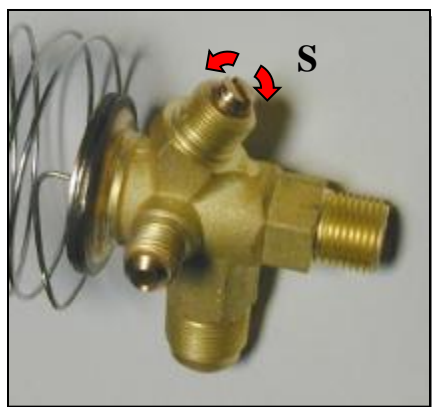


L'électrovanne (N.C.) est excitée lorsque le compresseur fonctionne /
The solenoid valve (N.C.) is energized when the compressor is running.

DETENDEUR EXPANSION VALVE



DETENDEUR EXPANSION VALVE

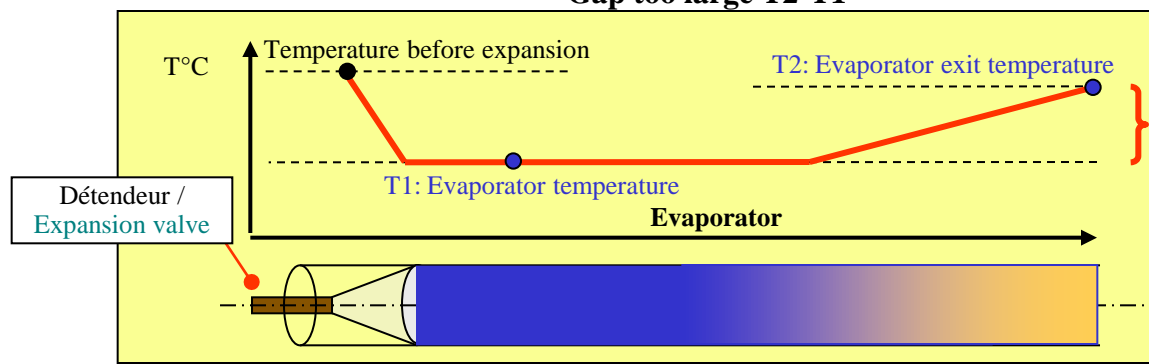


Réglage de l'écart de température T2-T1
T2-T1 temperature adjustment

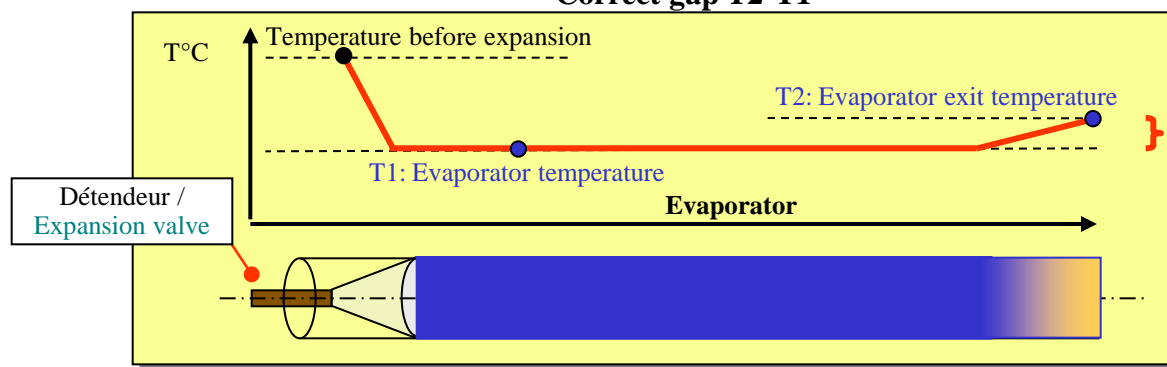


Buse / Diffuser

Gap too large T2-T1



Correct gap T2-T1



Evaporation du liquide / Liquid expansion

- Le détendeur abaisse la pression du liquide, il maintient un écart de température constant entre T2 (température à la sortie de l'évaporateur) et T1 (température d'évaporation)

Ajustement de l'écart de température T2-T1 réalisé avec la vis : S

- The expansion valve is used to expand the liquid, it keep constant the T2-T1 difference of temperature.

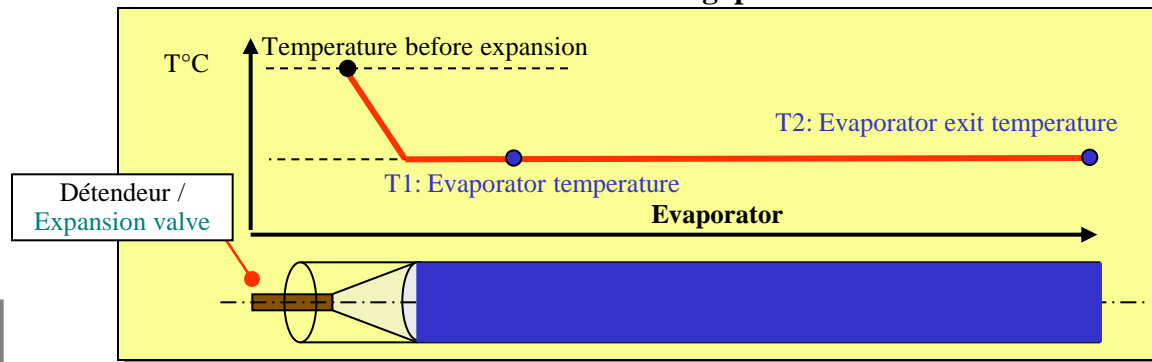
Adjustment of the T2-T1 difference of temperature with the screw : S

DETENDEUR EXPANSION VALVE

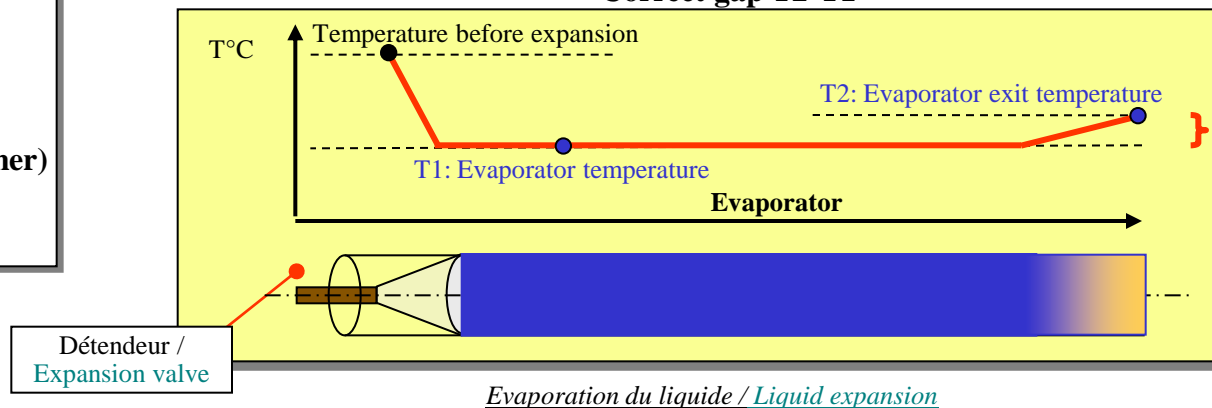
IMPORTANT:

→ If $T_2 - T_1 = 0$, no overheating
liquid go to compressor
=
Breakage of compressor (by liquid hammer)

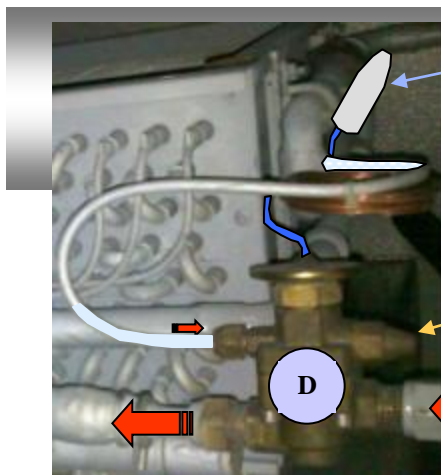
Insufficient gap $T_2 - T_1$



Correct gap $T_2 - T_1$



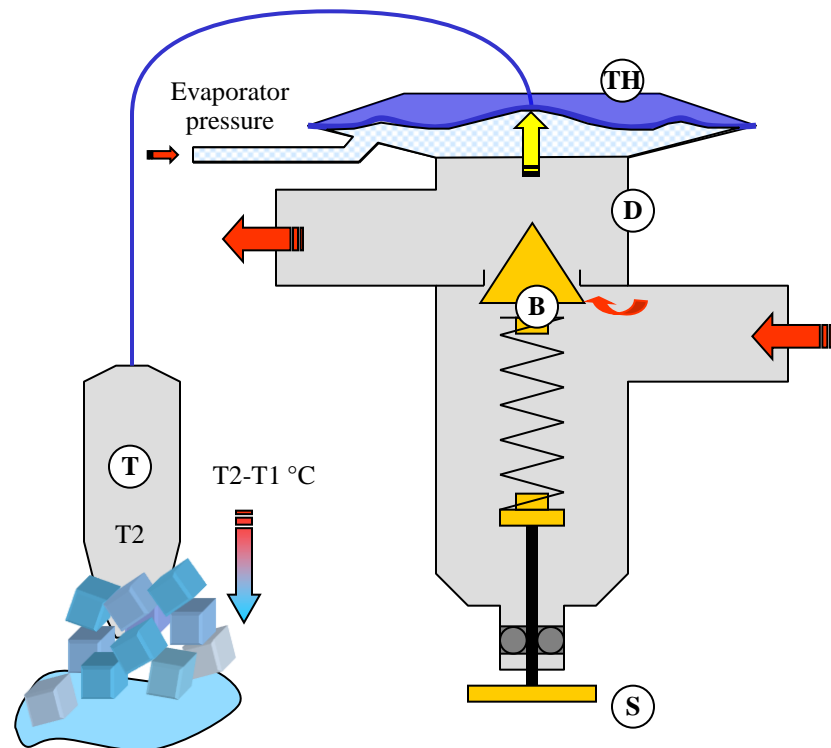
Evaporation du liquide / Liquid expansion



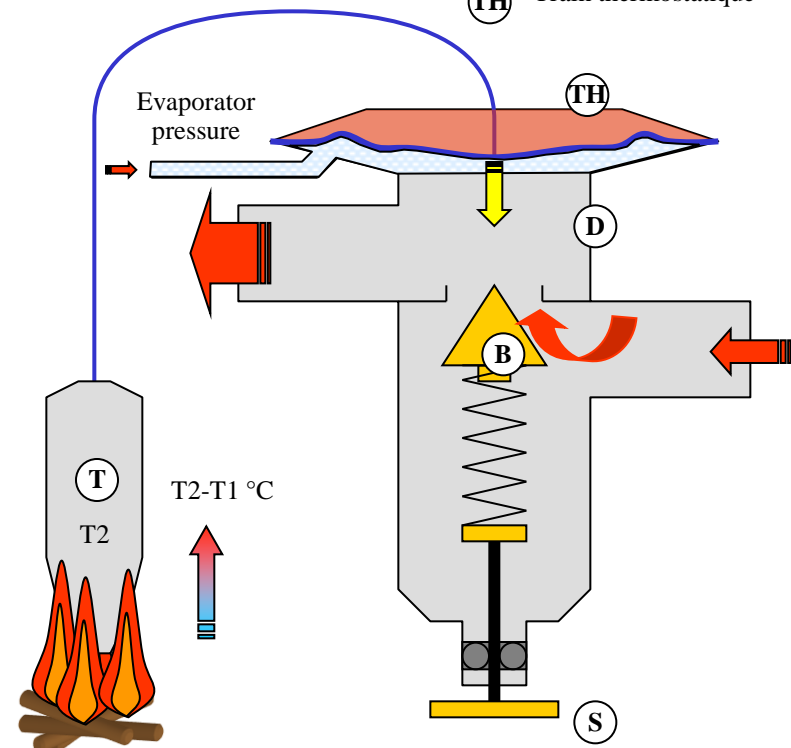
DETENDEUR EXPANSION VALVE

T2 : température du bulbe en sortie d'évaporateur
temperature of the bulb at the evaporator outlet
T1 : température d'évaporation
evaporating temperature

- (B) Buse / Diffuser
- (D) Détendeur / Expansion valve
- (S) Vis de réglage / Adjusting screw
- (T) Bulbe / Bulb
- (TH) Train thermostatique



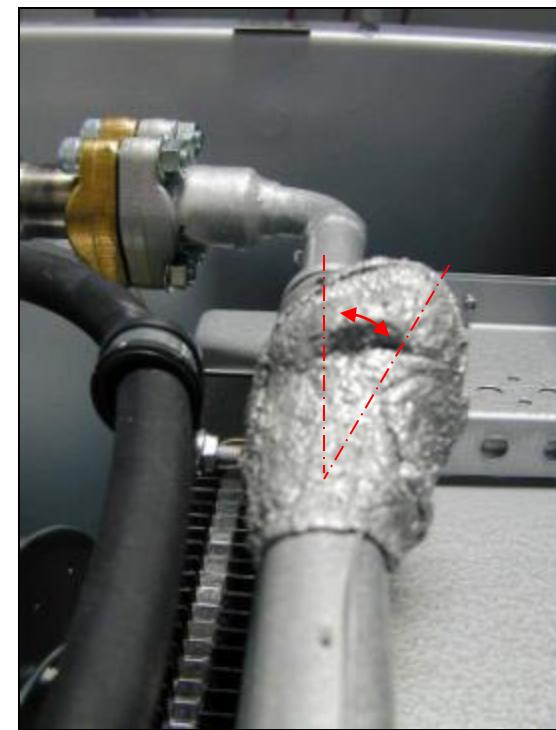
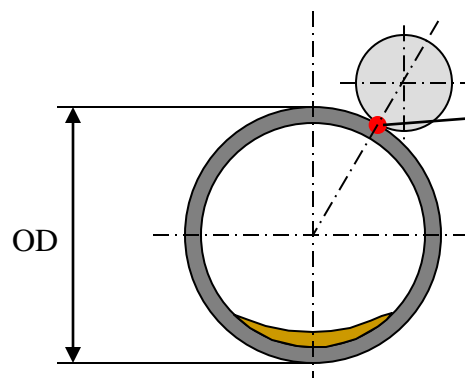
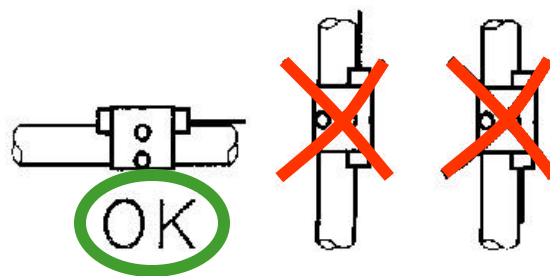
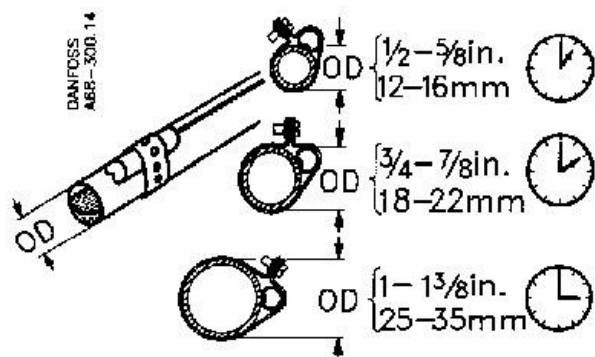
Si T2-T1 diminue, le détendeur se referme
If T2-T1 is down, the expansion valve is closing



Si T2-T1 augmente, le détendeur s'ouvre
If T2-T1 is high, the expansion valve is opening

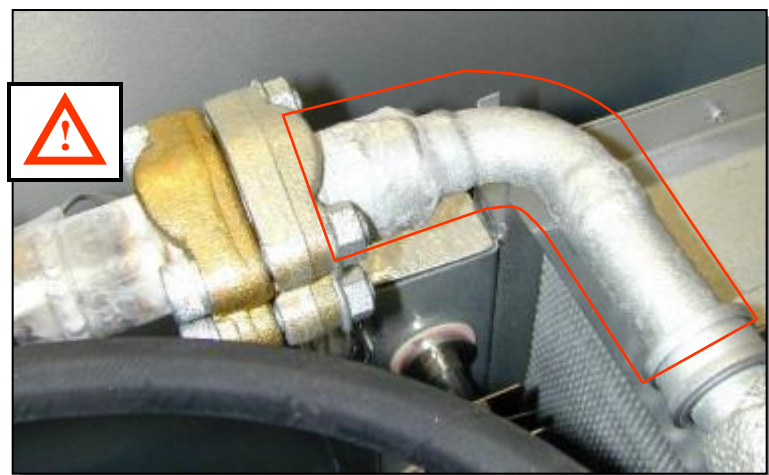
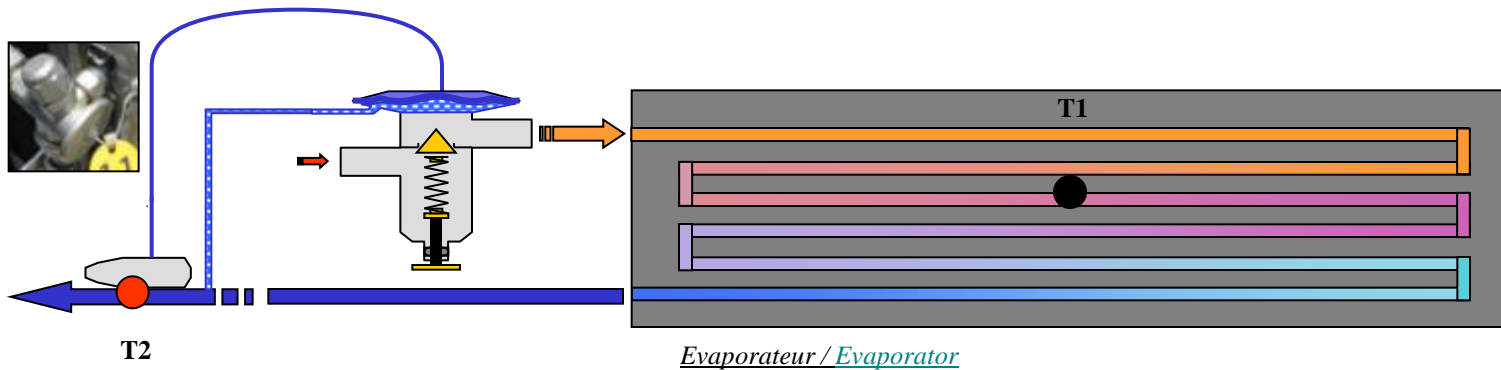
BULBE BULB

- Le bulbe est utilisé pour prendre la température en sortie d'évaporateur et ajuster précisément le fonctionnement du détendeur /
- The bulb is used to get the evaporator outlet temperature and to adjust accurately the functioning of the expansion valve.



AJUSTEMENT DU DETENDEUR

EXPANSIVE VALVE ADJUSTMENT



La température en sortie d'évaporateur (T2) ● doit être légèrement supérieure à la température d'évaporation (T1) ● /
The evaporator outlet temperature (T2) must be a little higher than the evaporating temperature (T1)

*Glace sur la canalisation: écart T2-T1 trop faible
ou pas assez de débit d'air /
Ice on the pipe: too low difference of T2-T1 temperatures
or not enough air flow*



*Réglage de la surchauffe /
Superheat adjustment*

IMPORTANT :
Pour ajuster un nouveau détendeur: compter le nombre de tours de la vis de réglage (S) sur l'ancien détendeur et transférer le réglage au nouveau, puis contrôler l'écart de température T2-T1 /
To adjust a new expansion valve: count the number of turns of the adjusting screw (S) of the old expansive valve and transfer the adjustment to the new one, then check the T2-T1 difference of temperature

ECART DE TEMPERATURE T2-T1

DIFFERENCE OF TEMPERATURE T2-T1



ATTENTION :

Si T2-T1 est proche de 0, il y a un risque de casse du compresseur par un coup de liquide.
If T2-T1 is near 0, there is a risk of breaking the compressor.

IMPORTANT :

Le réglage du détendeur est correct
si T2-T1 est compris
entre 5 et 10° avec du R134a
entre 15 et 20° avec du R227

The expansion valve adjustment is correct
if T2-T1 is between 5 and 10°C for R134a
between 15 and 20°C for R227

1 - Connecter le manomètre sur la vanne à l'aspiration du compresseur:

Connect the manometer onto the suction valve of the compressor

- La pression lue est la pression d'évaporation / You read the evaporator pressure
- La température lue sur le manomètre est la température d'évaporation T1 / It's the evaporator temperature at T1 on the manometer

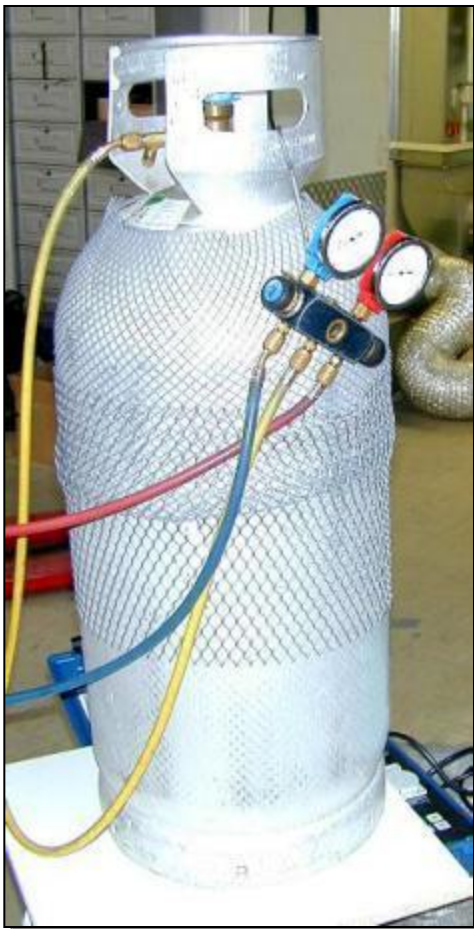
2 - Mesurer la température près du bulbe du détendeur avec une sonde de température:

Measure the temperature near the bulb of the expansion valve with a temperature sensor

- La température mesurée est la température T2 / It's the temperature at T2

FLUIDES FRIGORIFIQUES

REFRIGERANT GAS



	Avant / Before	Maintenant / Now
T ambiante > 60°C	R 114	R 227
T ambiante < 60°C	R 12	R 134a

IMPORTANT:

La pression du R134a est supérieure à la pression du R227.
Le R134a n'est pas adapté pour des températures ambiantes trop élevées.

The pressure of R134a is higher than the pressure of R227.
The R134a is not recommended for high ambient temperatures.

FLUIDE FRIGORIFIQUE – R 227

Pression absolue = Pression lue au manomètre + 1 bar

Température d'évaporation

Température Pression		Masse volumique		Volume massique		Enthalpie		Chaleur latente	Entropie	
t	p	rho'	rho''	v'	v''	h'	h''	r	s'	s''
[°C]	[bar]	[kg/dm ³]	[kg/m ³]	[dm ³ /kg]	[dm ³ /kg]	[kJ/kg]	[kJ/kg]	[kJ/kg]	[kJ/(kg·K)]	[kJ/(kg·K)]
-60	0.10	1.652	0.94	0.605	1068.06	137.91	285.75	147.84	0.7447	1.4383
-55	0.13	1.641	1.27	0.610	786.40	142.68	288.86	146.18	0.7669	1.4370
-50	0.18	1.628	1.70	0.614	588.58	147.53	292.01	144.49	0.7888	1.4363
-45	0.25	1.616	2.24	0.619	447.16	152.45	295.18	142.74	0.8106	1.4362
-40	0.32	1.603	2.90	0.624	344.47	157.44	298.38	140.93	0.8322	1.4367
-35	0.42	1.589	3.72	0.629	268.78	162.52	301.59	139.07	0.8537	1.4377
-30	0.54	1.575	4.71	0.635	212.21	167.66	304.81	137.15	0.8751	1.4391
-25	0.69	1.561	5.90	0.641	169.39	172.87	308.05	135.17	0.8963	1.4410
-20	0.87	1.546	7.32	0.647	136.57	178.16	311.29	133.13	0.9173	1.4432
-15	1.08	1.531	9.00	0.653	111.14	183.52	314.54	131.02	0.9382	1.4458
-10	1.33	1.515	10.96	0.660	91.22	188.95	317.79	128.84	0.9590	1.4486
-5	1.62	1.499	13.25	0.667	75.46	194.44	321.03	126.59	0.9796	1.4517
0	1.96	1.482	15.90	0.675	62.88	200.00	324.27	124.27	1.0000	1.4550
5	2.35	1.465	18.96	0.683	52.74	205.64	327.50	121.86	1.0204	1.4585
10	2.80	1.446	22.47	0.691	44.51	211.33	330.71	119.38	1.0406	1.4622,
15	3.32	1.428	26.48	0.700	37.77	217.10	333.91	116.81	1.0606	1.4660
20	3.90	1.408	31.05	0.710	32.21	222.93	337.08	114.14	1.0806	1.4700
25	4.56	1.388	36.24	0.720	27.59	228.84	340.22	111.38	1.1004	1.4740
30	5.29	1.367	42.15	0.732	23.73	234.82	343.32	108.50	1.1201	1.4780
35	6.11	1.345	48.84	0.744	20.48	240.87	346.37	105.50	1.1397	1.4821
40	7.03	1.322	56.43	0.756	17.72	247.01	349.37	102.36	1.1593	1.4861
45	8.04	1.298	65.05	0.771	15.37	253.24	352.30	99.06	1.1788	1.4901
50	9.16	1.272	74.85	0.786	13.36	259.58	355.15	95.57	1.1982	1.4940
55	10.40	1.246	86.03	0.803	11.62	266.02	357.90	91.87	1.2177	1.4977
60	11.75	1.217	98.85	0.822	10.12	272.60	360.52	87.92	1.2373	1.5012
65	13.24	1.187	113.64	0.843	8.80	279.34	362.99	83.65	1.2570	1.5044
70	14.87	1.154	130.87	0.867	7.64	286.26	365.25	78.99	1.2769	1.5071

FLUIDE FRIGORIFIQUE – R 134a

Pression absolue = Pression lue au manomètre + 1 bar

Température d'évaporation

Température Pression		Masse volumique		Volume massique		Enthalpie		Chaleur latente	Entropie	
t	p	rho'	rho''	v'	v''	h'	h''	r	s'	s''
[°C]	[bar]	[kg/dm³]	[kg/m³]	[dm³/kg]	[dm³/kg]	[kJ/kg]	[kJ/kg]	[kJ/kg]	[kJ/(kg·K)]	[kJ/(kg·K)]
-60	0.16	1.475	0.93	0.678	1078.97	123.16	361.37	238.21	0.6859	1.8012
-55	0.22	1.461	1.25	0.684	802.33	129.49	364.53	235.04	0.7135	1.7904
-50	0.29	1.447	1.65	0.691	606.16	135.75	367.70	231.95	0.7409	1.7808
-45	0.39	1.433	2.15	0.698	464.67	141.98	370.86	228.89	0.7681	1.7722
-40	0.51	1.418	2.77	0.705	361.01	148.21	374.02	225.81	0.7950	1.7645
-35	0.66	1.404	3.52	0.712	283.94	154.47	377.17	222.70	0.8217	1.7576
-30	0.84	1.389	4.43	0.720	225.87	160.77	380.31	219.54	0.8480	1.7515
-25	1.06	1.374	5.51	0.728	181.55	167.13	383.42	216.29	0.8741	1.7460
-20	1.33	1.359	6.79	0.736	147.33	173.56	386.51	212.95	0.8999	1.7412
-15	1.64	1.343	8.29	0.744	120.61	180.06	389.56	209.51	0.9254	1.7369
-10	2.01	1.327	10.05	0.753	99.54	186.63	392.58	205.95	0.9505	1.7331
-5	2.43	1.311	12.08	0.763	82.76	193.27	395.56	202.29	0.9754	1.7297
0	2.93	1.295	14.43	0.772	69.28	200.00	398.49	198.49	1.0000	1.7267
5	3.50	1.278	17.14	0.782	58.35	206.79	401.37	194.58	1.0243	1.7241
10	4.15	1.261	20.23	0.793	49.43	213.65	404.19	190.54	1.0484	1.7217
15	4.88	1.243	23.76	0.804	42.08	220.58	406.94	186.35	1.0723	1.7196
20	5.72	1.225	27.78	0.816	35.99	227.59	409.61	182.02	1.0960	1.7176
25	6.65	1.206	32.35	0.829	30.91	234.67	412.20	177.53	1.1195	1.7158
30	7.70	1.187	37.53	0.842	26.65	241.83	414.69	172.86	1.1429	1.7141
35	8.87	1.167	43.40	0.857	23.04	249.08	417.07	168.00	1.1663	1.7124
40	10.17	1.146	50.06	0.872	19.98	256.43	419.33	162.90	1.1897	1.7107
45	11.60	1.125	57.62	0.889	17.36	263.90	421.44	157.54	1.2132	1.7090
50	13.18	1.102	66.21	0.908	15.10	271.52	423.38	151.86	1.2367	1.7071
55	14.92	1.078	76.03	0.928	13.15	279.32	425.12	145.80	1.2605	1.7049
60	16.82	1.053	87.28	0.950	11.46	287.33	426.63	139.30	1.2845	1.7024
65	18.90	1.026	100.27	0.975	9.97	295.60	427.84	132.24	1.3089	1.6994
70	21.17	0.996	115.42	1.004	8.66	304.18	428.70	124.52	1.3337	1.6957

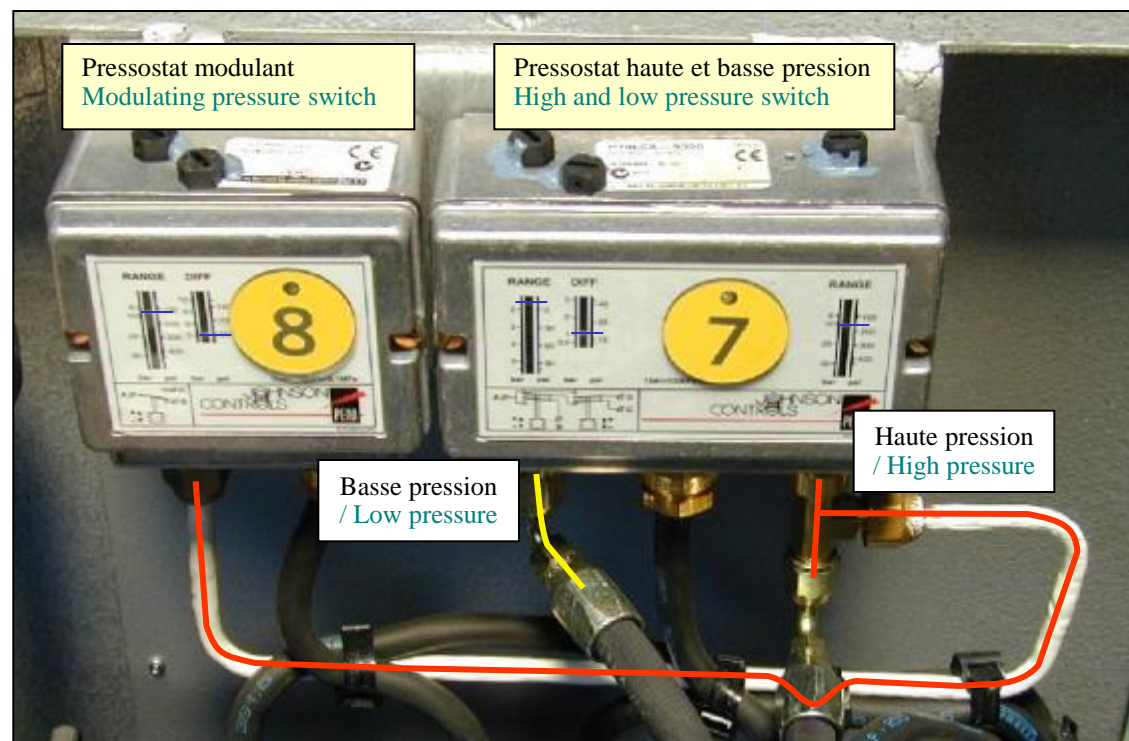
PRESSOSTAT HAUTE ET BASSE PRESSION HIGH AND LOW PRESSURE SWITCH

- Le pressostat modulant (8) met en route et arrête le ventilateur de la partie condenseur.
- Le pressostat haute et basse pression (7) arrête le compresseur si la pression est trop haute ou trop basse.

- The modulating pressure switch (8) actuates and stops the condenser compartment fan.
- The high and low pressure switch (7) stops the compressor when the pressure is too high or too low.



Danfoss



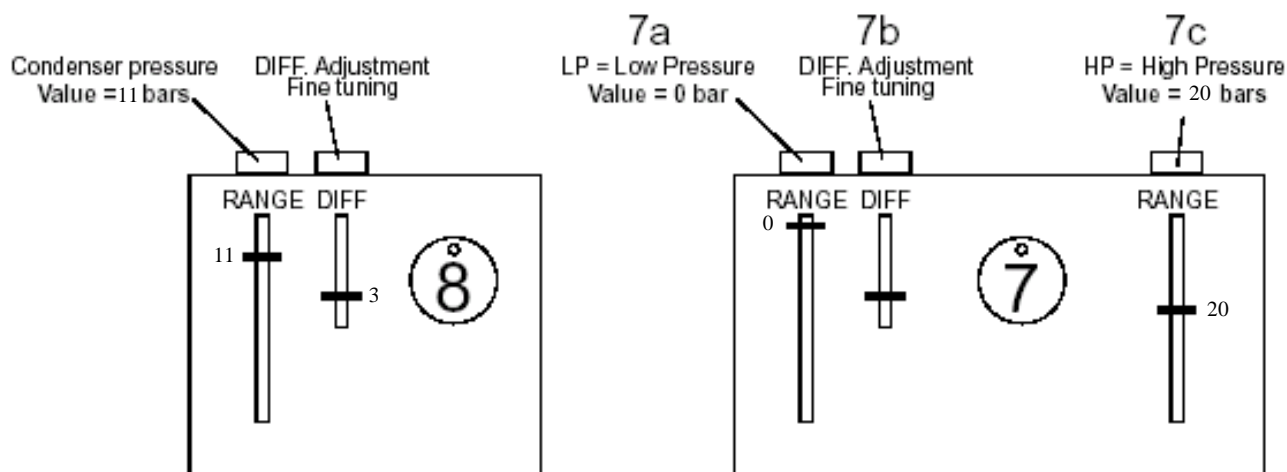
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PRESSOSTAT HAUTE ET BASSE PRESSION

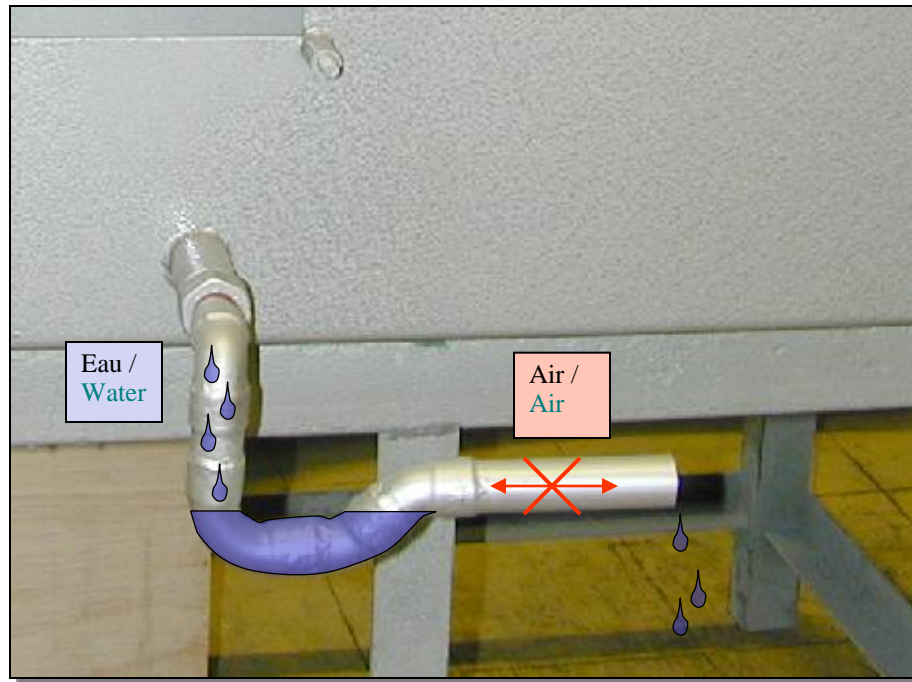
HIGH AND LOW PRESSURE SWITCH

Rep	Designation	PSIG	BAR
7a	<u>Low pressure switch</u>		
	OFF	0	0
	ON	5,2	0,36
7c	<u>High pressure switch</u>		
	OFF	348	24
	ON	290	20
8	<u>Condenser pressure switch</u>		
	OFF	116	8
	ON	160	11
21	<u>T° in cab</u>		25°C
	<u>T° in electrical room</u>		30°C

Diff 4



SIPHON SIPHON



Siphon d'évacuation de l'eau / [Water evacuation siphon](#)

IMPORTANT :

Le siphon permet d'éviter des échanges d'air entre la partie froide et l'atmosphère.
The siphon avoid air exchange between the cool part of the air conditioning system and the ambient air.

PANNEAU ELECTRIQUE

ELECTRICAL PANEL



Ventilateur condenseur
Condenser fan

Compresseur
Compressor

Commande
Command

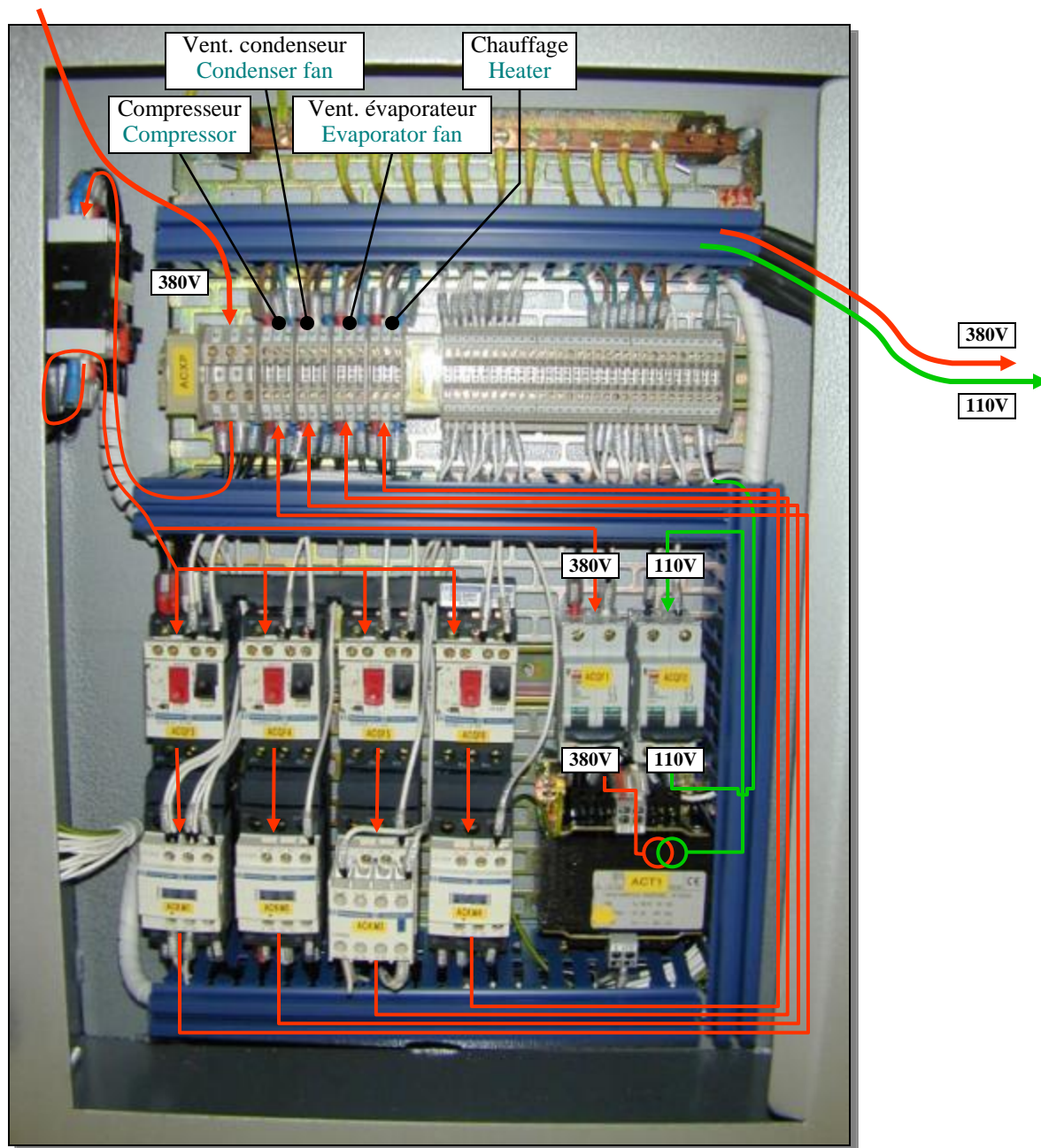
Transformateur 380/110V
Transformer 380/110V

Chauffage
Heater

Ventilateur évaporateur
Evaporator fan

DETAILS DETAILS

ACQF1		Transformateur 380/110 V Transformer 380/110 V
ACQF2		Commande + préchauffage comp. Command + comp. preheater
ACQF3	ACKM1	Compresseur Compressor
ACQF4	ACKM2	Vent. condenseur Condenser fan
ACQF5	ACKM3	Vent. évaporateur Evaporator fan
ACQF6	ACKM4	Chauffage cabine Cabin heater







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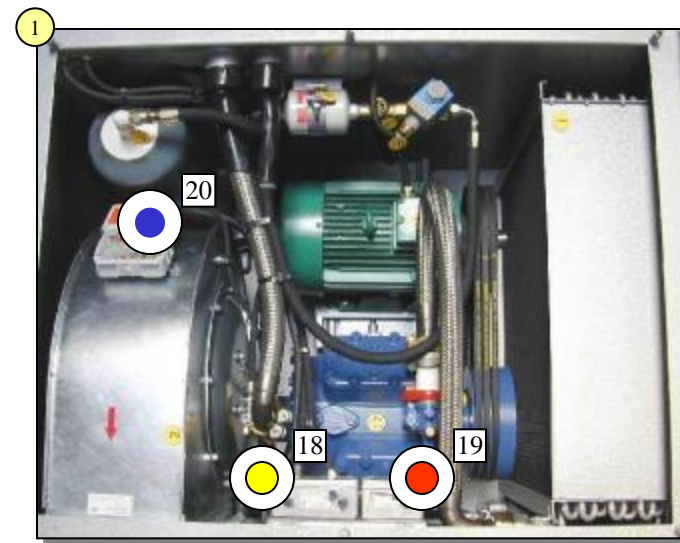
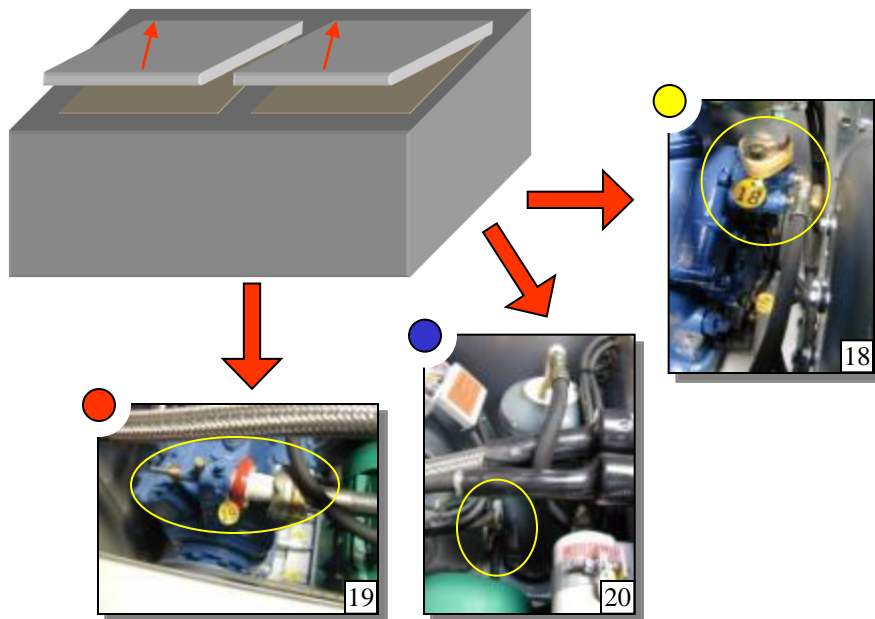
EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MISE EN ROUTE COMMISSIONING

MISE EN ROUTE COMMISSIONING

-  1 - Ouvrir les portes du compartiment du condenseur.
- Repérer les 3 vannes (18, 19, 20).

-  1 - Open the condenser compartment doors.
- Be aware on the 3 gates (18, 19, 20).



Localisation des vannes / Gates localization

MISE EN ROUTE COMMISSIONING



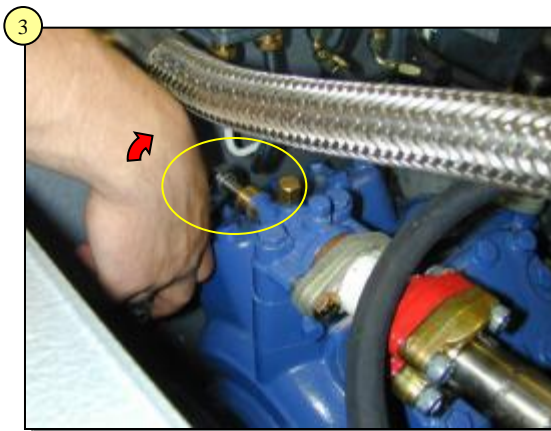
- 2 - Dévisser le capuchon de protection de chaque vanne.
- 3 - Ouvrir totalement les 3 vannes: aspiration **18**, refoulement **19** et départ liquide **20** (pour **18** et **20** resserrer d'un tour pour avoir la connexion avec le pressostat).

Si il est difficile d'ouvrir ou de fermer la vanne: voir la note



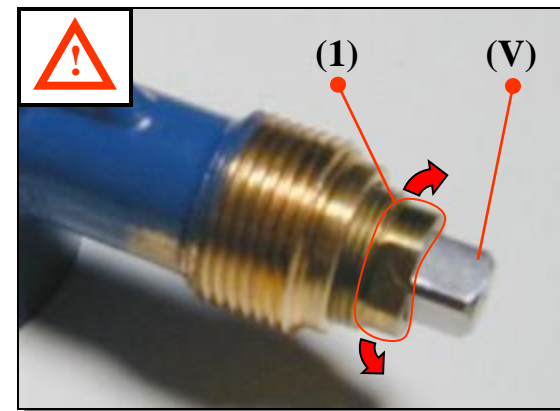
- 2 - Unscrew the black cover of each gate.
- 3 - Open totally the 3 gates: inlet gate **18**, refill gate **19** and liquid outlet gate valve **20** (for **18** and **20** close them back of 1 turn in order to have the pressure switch connection).

If it is difficult to open or close the gate: see remark.



IMPORTANT :

Pour la vanne d'aspiration **18** et départ liquide **20** desserrer à fond et resserrer d'un tour.
For the inlet gate valve **18** and liquid outlet gate valve **20** open totally and close it back of 1 turn.



IMPORTANT :

Pour ouvrir ou fermer une vanne (V) il est préférable de desserrer l'écrou du joint de tige (1) de 1/4 tour.
Resserrer juste après opération pour éviter les fuites.
To open or close a gate (V) it is better to unscrew 1/4 turn the stem seal nut (1).
Tight immediately after operation to avoid leaks.

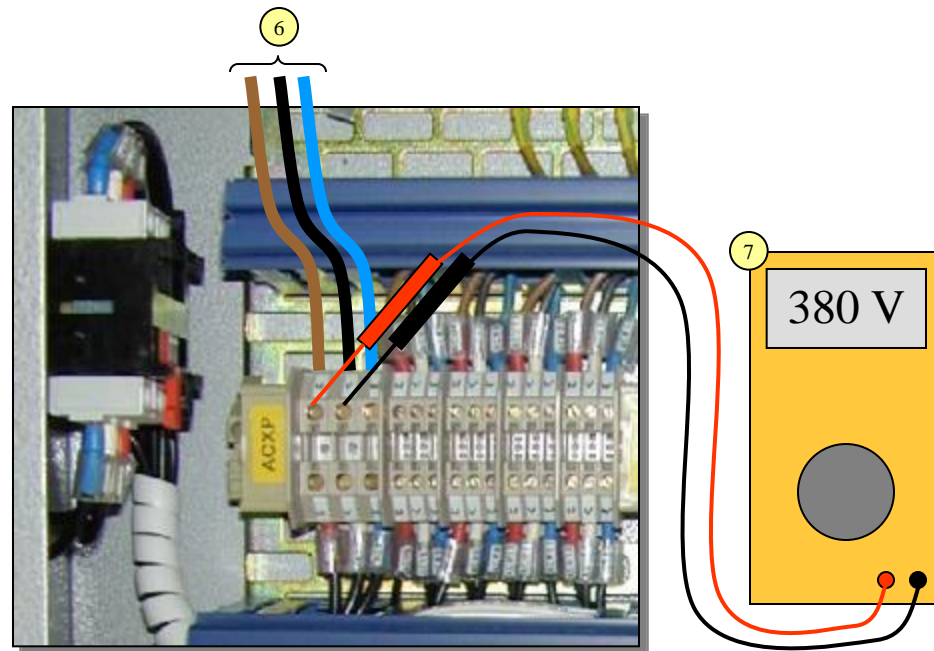
MISE EN ROUTE COMMISSIONING



- ④ - Revisser le capuchon de protection de chaque vanne.
- ⑤ - Vérifier que **ACQ1** est désactivé.
- ⑥ - Connecter le câble d'alimentation électrique.
- ⑦ - Vérifier l'alimentation en 380 V.



- ④ - Put back and screw the black cover of each gate.
- ⑤ - Check that **ACQ1** is switched off.
- ⑥ - Connect the electrical power wire.
- ⑦ - Check the 380 V power supply.



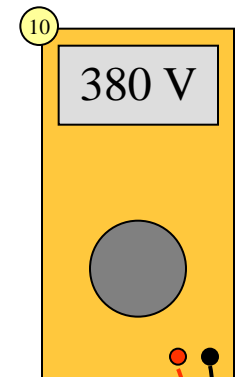
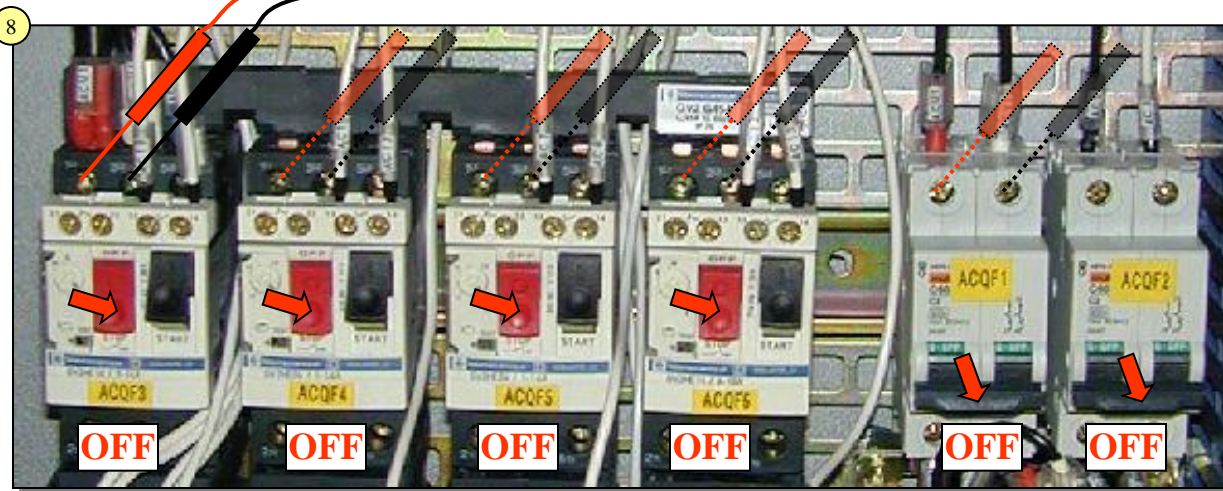
MISE EN ROUTE COMMISSIONING



- 8 - Vérifier que **ACQF1, ACQF2, ACQF3, ACQF4, ACQF5** et **ACQF6** sont désactivés.
- 9 - Activer le disjoncteur **ACQ1**.
- 10 - Vérifier l'alimentation en 380 V en **ACQF1, ACQF3, ACQF4, ACQF5** et **ACQF6**.



- 8 - Check that **ACQF1, ACQF2, ACQF3, ACQF4, ACQF5** and **ACQF6** are switched off.
- 9 - Switch on the breaker **ACQ1**.
- 10 - Check the 380 V power supply of **ACQF1, ACQF3, ACQF4, ACQF5** and **ACQF6**.



MISE EN ROUTE COMMISSIONING

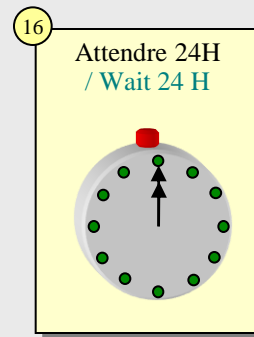
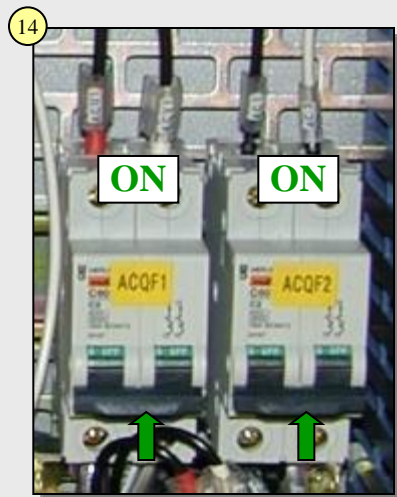
----- A SUIVRE POUR LE PREMIER DÉMARRAGE OU SI LA CLIMATISATION N'A PAS ÉTÉ DÉMARRÉE DEPUIS UN LONG MOMENT -----
----- TO FOLLOW FOR THE FIRST STARTING OR IF THE AIR CONDITIONING HAS NOT BEEN STARTED FOR A LONG TIME -----



- ⑭ - Activer **ACQF1, ACQF2**.
- ⑮ - Activer le disjoncteur **ACQ1**.
- ⑯ - Refermer les capots et attendre 24H afin de réchauffer le carter du compresseur et séparer le gaz de l'huile.
- ⑰ - Désactiver le disjoncteur **ACQ1**.



- ⑭ - Actuate **ACQF1, ACQF2**.
- ⑮ - Switch on the breaker **ACQ1**.
- ⑯ - Close all the doors and wait 24H in order to preheat the compressor housing and separate the gas from the oil.
- ⑰ - Switch off the breaker **ACQ1**.



MISE EN ROUTE COMMISSIONING

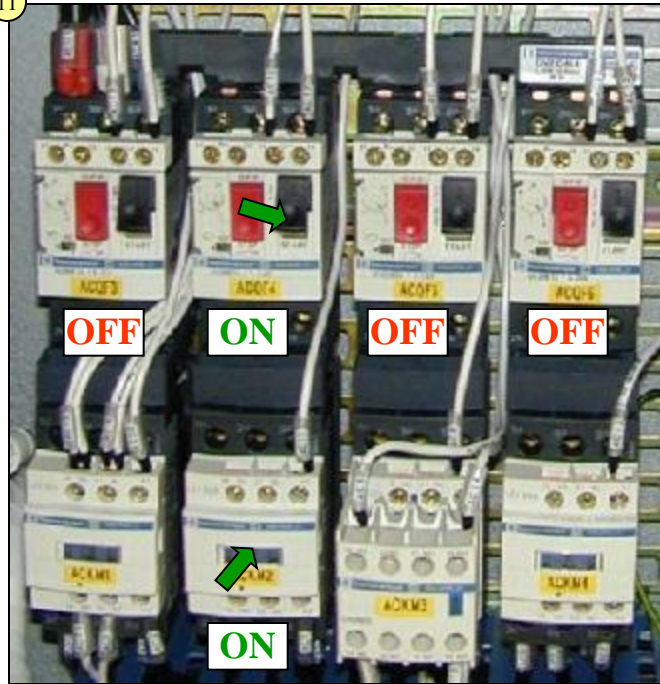


- 11 - Activer **ACQF4** et pousser sur le contacteur **ACKM2** pour vérifier le sens de rotation du moteur du ventilateur du condenseur. Si le sens de rotation du moteur n'est pas correct, inverser 2 phases sur le bornier **ACXP**.



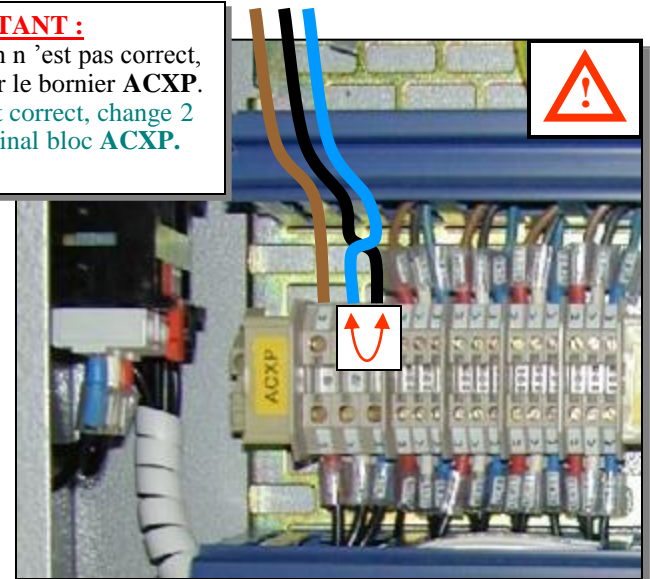
- 11 - Switch on the breaker **ACQF4** and push on **ACKM2** to control the correct rotation of the motor. If the rotation direction of the motor is not correct, change 2 phases of the terminal bloc **ACXP**.

11



IMPORTANT :

Si le sens de rotation n'est pas correct, inverser 2 phases sur le bornier **ACXP**.
If the rotation is not correct, change 2 phases of the terminal bloc **ACXP**.



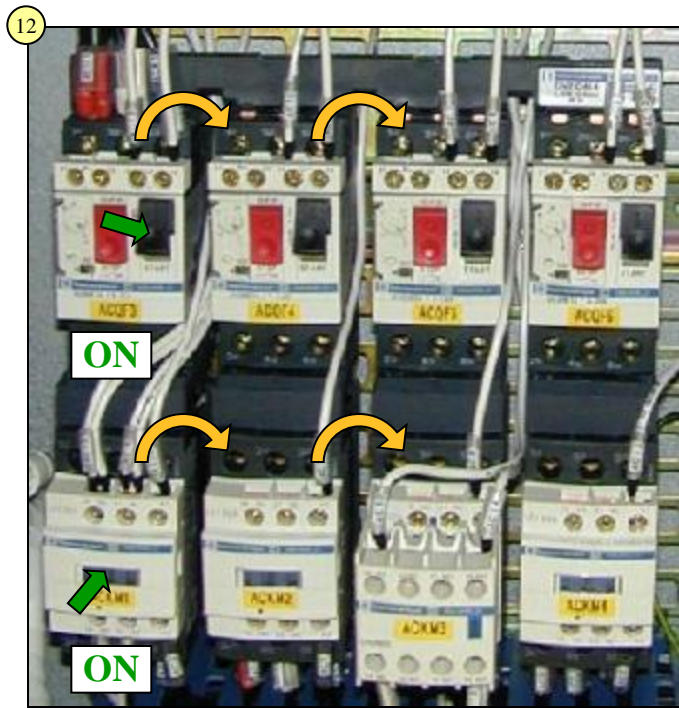
MISE EN ROUTE COMMISSIONING



- 12 - Contrôler à nouveau le sens de rotation des 3 moteurs en activant tour à tour **ACQF3** et **ACKM1** puis **ACQF4** et **ACKM2** puis **ACQF5** et **ACKM3**.
- 13 - Désactiver le disjoncteur **ACQ1**.



- 12 - Control again the correct rotation direction of the 3 motors by switching 1 by 1 **ACQF3** et **ACKM1** puis **ACQF4** et **ACKM2** puis **ACQF5** et **ACKM3**.
- 13 - Switch off the breaker **ACQ1**.



MISE EN ROUTE COMMISSIONING



- 18 - Activer **ACQF1**, **ACQF2**, **ACQF3**, **ACQF4**, **ACQF5** et **ACQF6**.
- Activer le disjoncteur **ACQ1**.

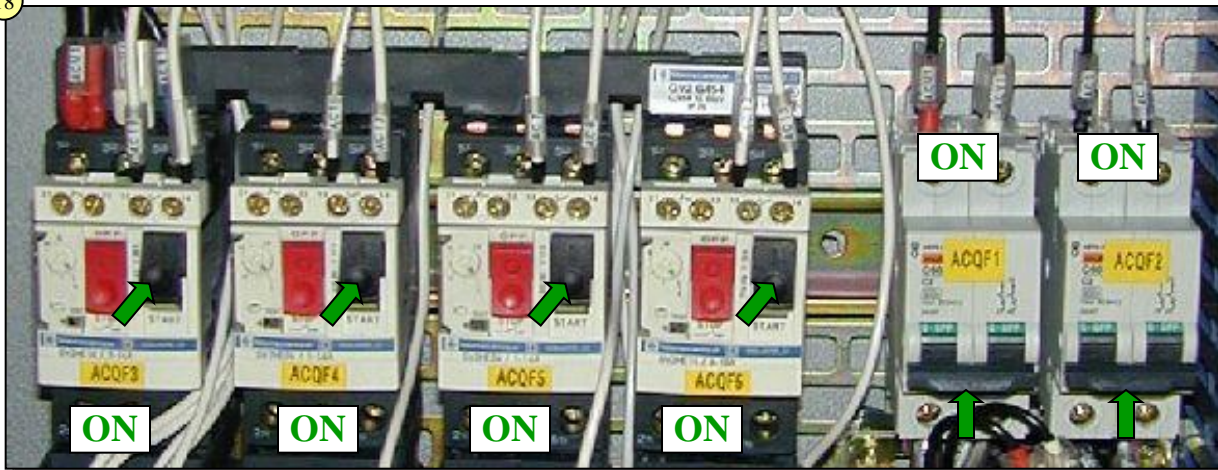


- 18 - Actuate **ACQF1**, **ACQF2**, **ACQF3**, **ACQF4**, **ACQF5** and **ACQF6**.



- Switch on the breaker **ACQ1**.

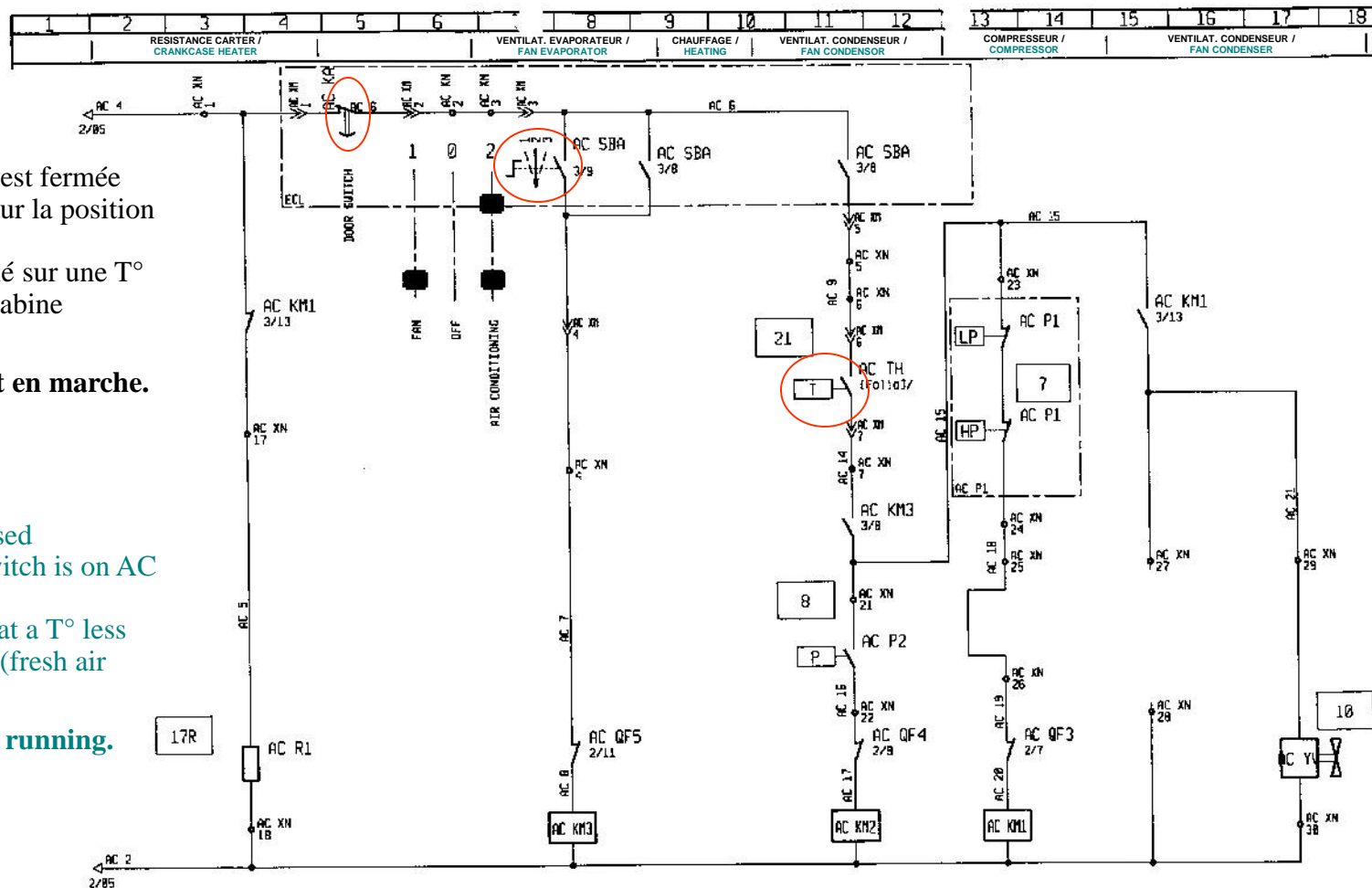
18



19



MISE EN ROUTE COMMISSIONING



Extrait d'un schéma électrique (sans chauffage) / Extract of an electrical drawing (without heater)

- Contrôler que:
- La porte de la cabine est fermée
 - Le commutateur est sur la position air conditionné
 - Le thermostat est réglé sur une T° inférieure à la T° de la cabine (demande d'air froid).

La climatisation se met en marche.

- Check that:
- The cabin door is closed
 - The cabin selector switch is on AC position
 - The thermostat is set at a T° less than the T° of the cabin (fresh air demand).

The air conditioning is running.

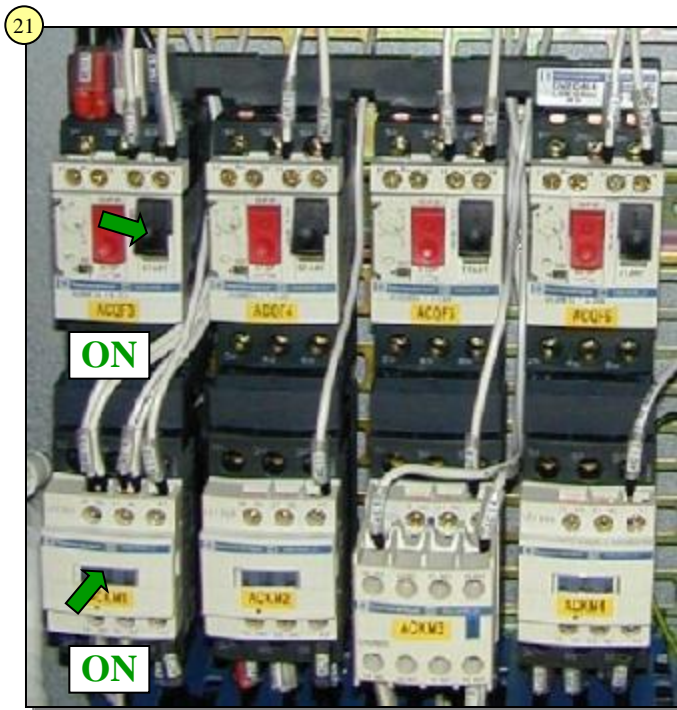
MISE EN ROUTE COMMISSIONING



- (21) - Si le climatiseur ne démarre pas:
Activer manuellement le contacteur **ACKM3** durant 10 secondes afin d'ajuster les pressions. En relâchant le contacteur la climatisation doit rester en marche.



- (21) - If the air conditioning does not start:
Actuate manually the contactor **ACKM3** during 10 seconds in order to equilibrate the pressures. When you release the contactor, the air conditioning must remain working.





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EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE

EVERY MONTHS :

BLOWING OF CONDENSER, EVAPORATOR & FILTERS

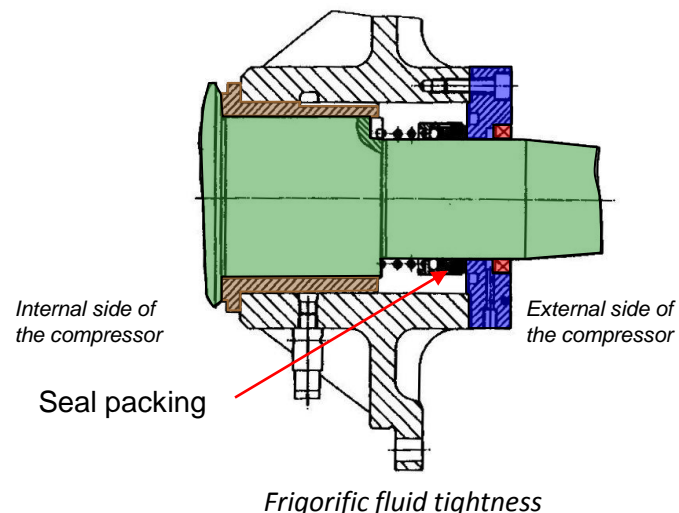
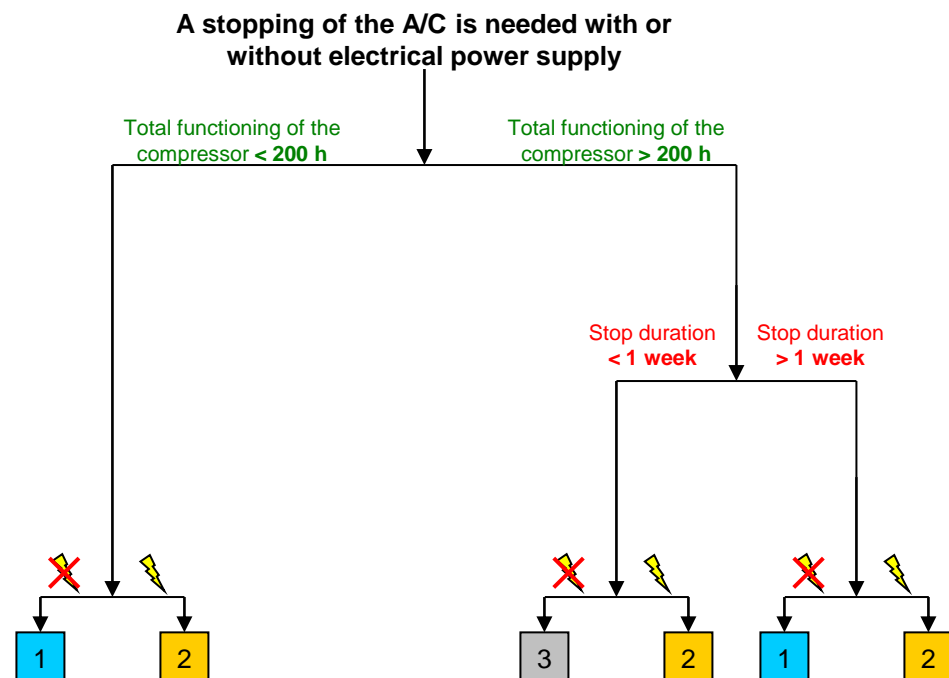
EVERY YEARS :

CHANGE OIL



CLEANING CARTER

CLEANING FANS

IN CASE OF LONG STOPPING OF A/C WITH OR WITHOUT ELECTRICAL POWER SUPPLY

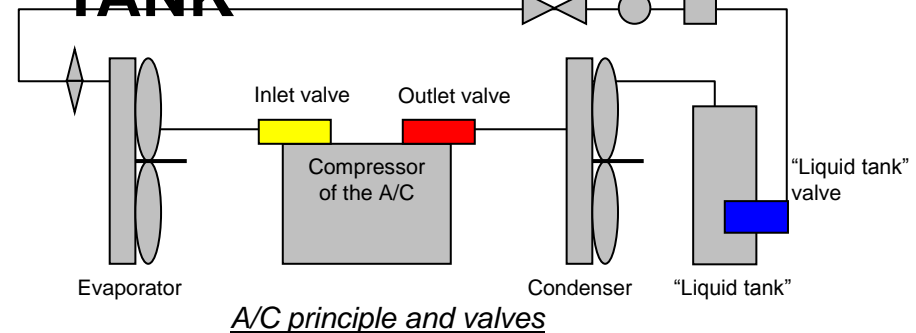


- 1** : Stock the frigorific fluid in the « liquid tank »
- 2** : Engage the compressor pre-heating
- 3** : Nothing special to do

-  : Electrical power supply is available
-  : Electrical power supply is not available

IN CASE OF LONG STOPPING OF A/C HOW TO STOCK FRIGORIFIC FLUID IN THE

TANK



Step 1 : Close the valve (blue) of « liquid tank »

Step 2 : Switch on the A/C by using the thermostat with fresh air demand (low temperature request)

Step 3 : When the LP (low pressure) pressure switch is activated the compressor's motor stops

As soon as it stops, close the inlet valve (yellow)

Step 4 : Switch off the electrical supply of the A/C

18 19 20



Vanne-robinet / Gas gate valve



<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

**THANK YOU FOR YOUR
ATTENTION**



EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MA'ADEN project

P1034

PTA - POT TENDING ASSEMBLY

CANDI™ – Silver
INSULATION MONITORING DEVICE

<http://www.ecl.fr>

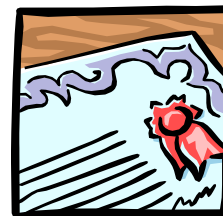
SILVER™ Aim of the Training

The aim of this training is to give you a **better knowledge to assess the risks** associated with the specific insulation design of the ECL potline cranes.

It will assist you to **maintain a safe working environment** for you and anyone who accesses the crane.

It will assist you to **guarantee and provide a high standard of maintenance** of the monitoring device

It will assist you to **achieve rapid and efficient fault finding** to improve **crane safety and availability**



Note that this training does not supersede any rules and regulations applied on your site.

SILVER™

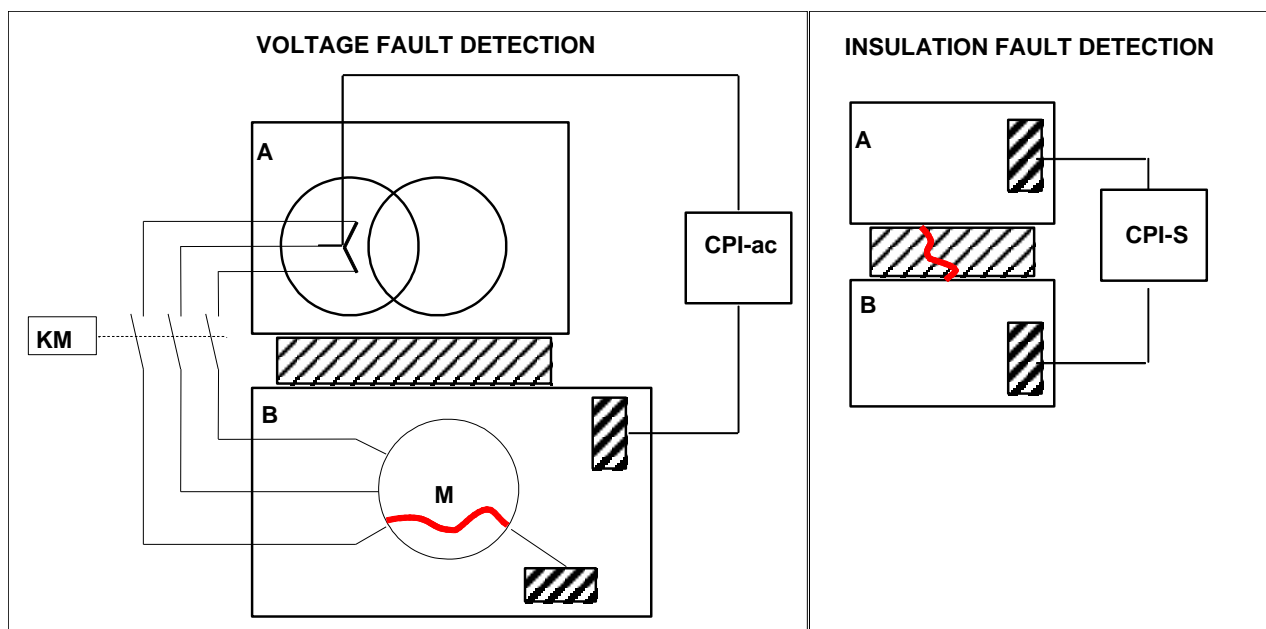
Definition and Purpose

The insulation monitoring system called SILVER™ is a device use to detect:

- insulation faults between different structural parts of the machine
- deficiencies of electric power circuits

This system is composed of:

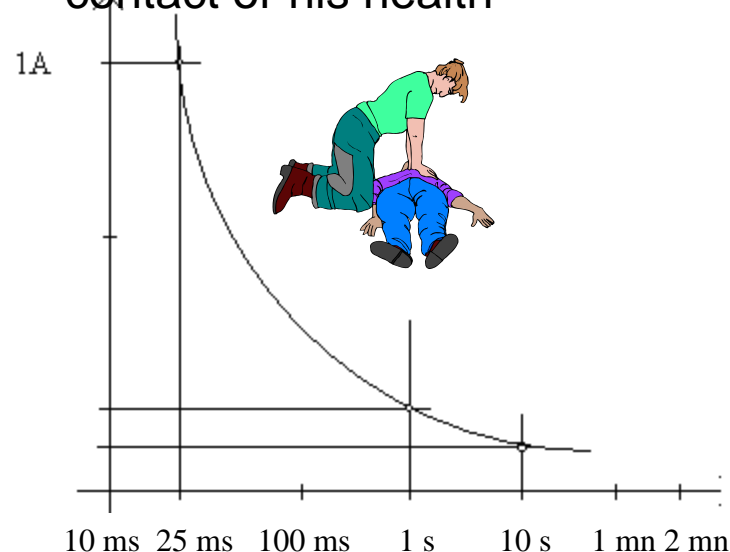
- insulation monitoring devices **(CPI-S) > 10 Mégohms**
- Power voltage detection relays **(CPI-ac)**



Why monitor insulation of the cranes? Risk of electrical shock

An electric shock is the result of a current going through the body of a person in contact with two electrical conductors at two different potentials. The consequences can be **FATAL** depending on the value of the current and the duration of the electrocution.

The following graph shows that the lower is the value of the current, the more time a body can support it. However, the reaction of one body can be different from one person to another depending on the part of the body in contact or his health



Why monitor insulation of the cranes? Risk of electrical shock

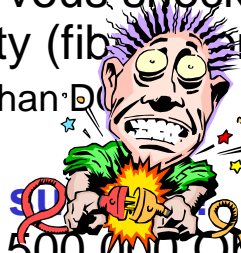
Current kills and not voltage as a lot of people think.

-1 to 3 mA : Low risk. However a person might feel light sensations and therefore people might have “bad reflexes” and fall (e.g. working in height).

-10 to 15 mA : High risks of muscular contractions, tetanization involving breath taking, paralysis, nervous shock

-Above 30 mA : Risk of fatality (fibrillation).

Note that risk is higher in AC than in DC



So What voltage can we so

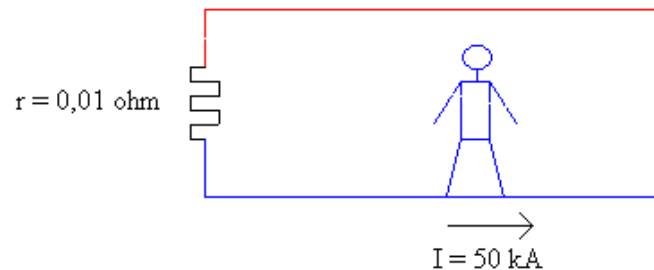
The resistance of a body might change from 500,000 Ohms to 100 Ohms whether you are in your bath or there is a small surface of your body in contact. As an average, the assumption commonly used in the industry is **3,000 Ohms** for a hand to hand body resistance.

Therefore, if we take **16 mA** as being the maximal current admissible for the human body, then the maximal voltage will be **50V** :

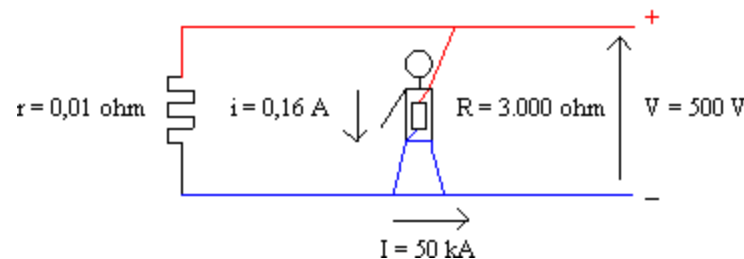
$$I = V/R = 50/3000 = 16 \text{ mA}$$

Why monitor insulation of the cranes? Understanding difference of potential

It is the current that goes through your body that generates the risk. Consequently, the very high intensity of a current that goes through a conductor which you are in contact with (e.g. a pot) is not dangerous as it is at the same potential as you are.

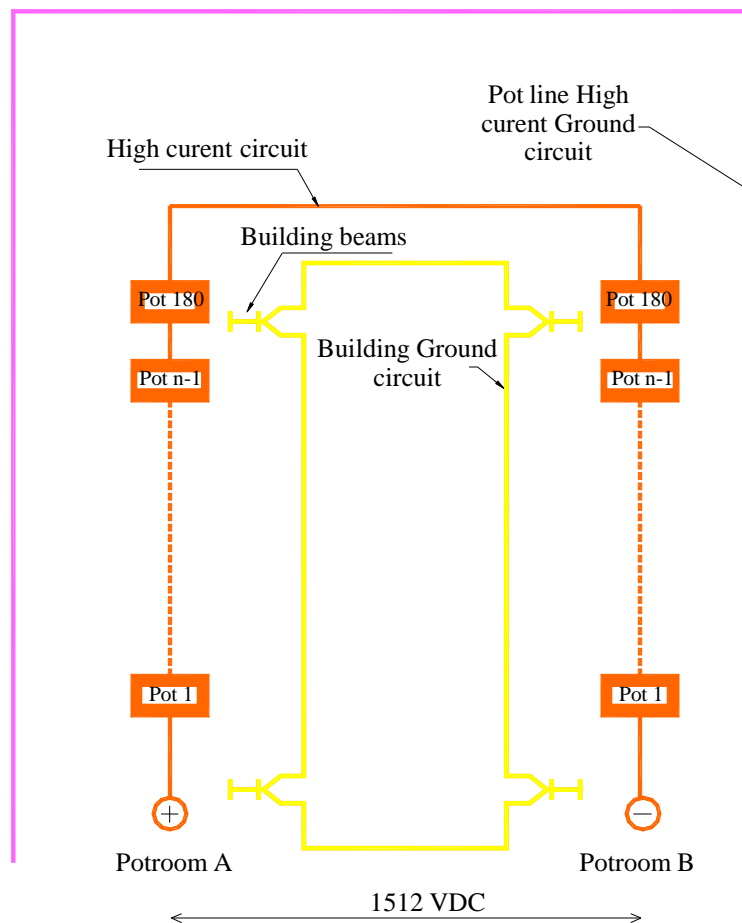


Even if you are at a different potential, it is still not the full current that will go through you but the intensity will vary with the difference of potential and your internal resistance:

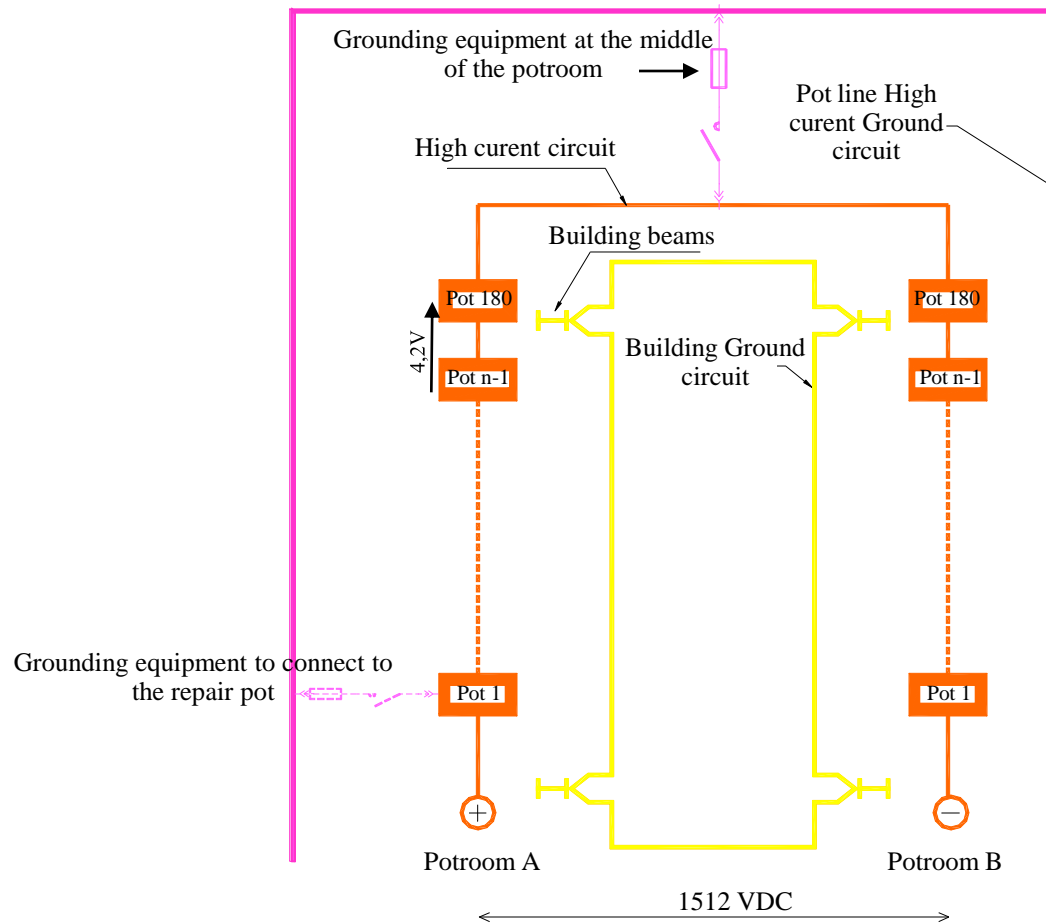




What about a smelter? Working on the pots



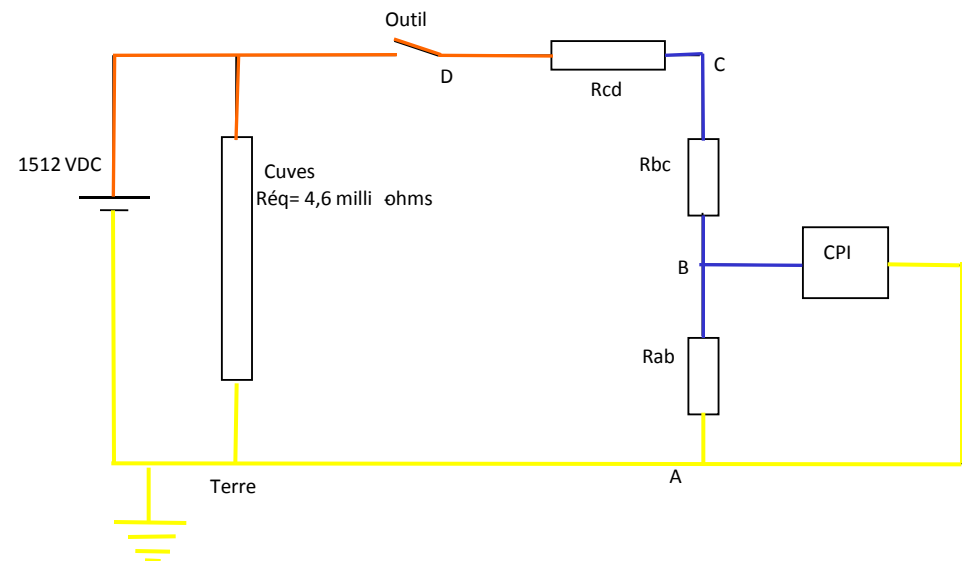
Grounding Circuit



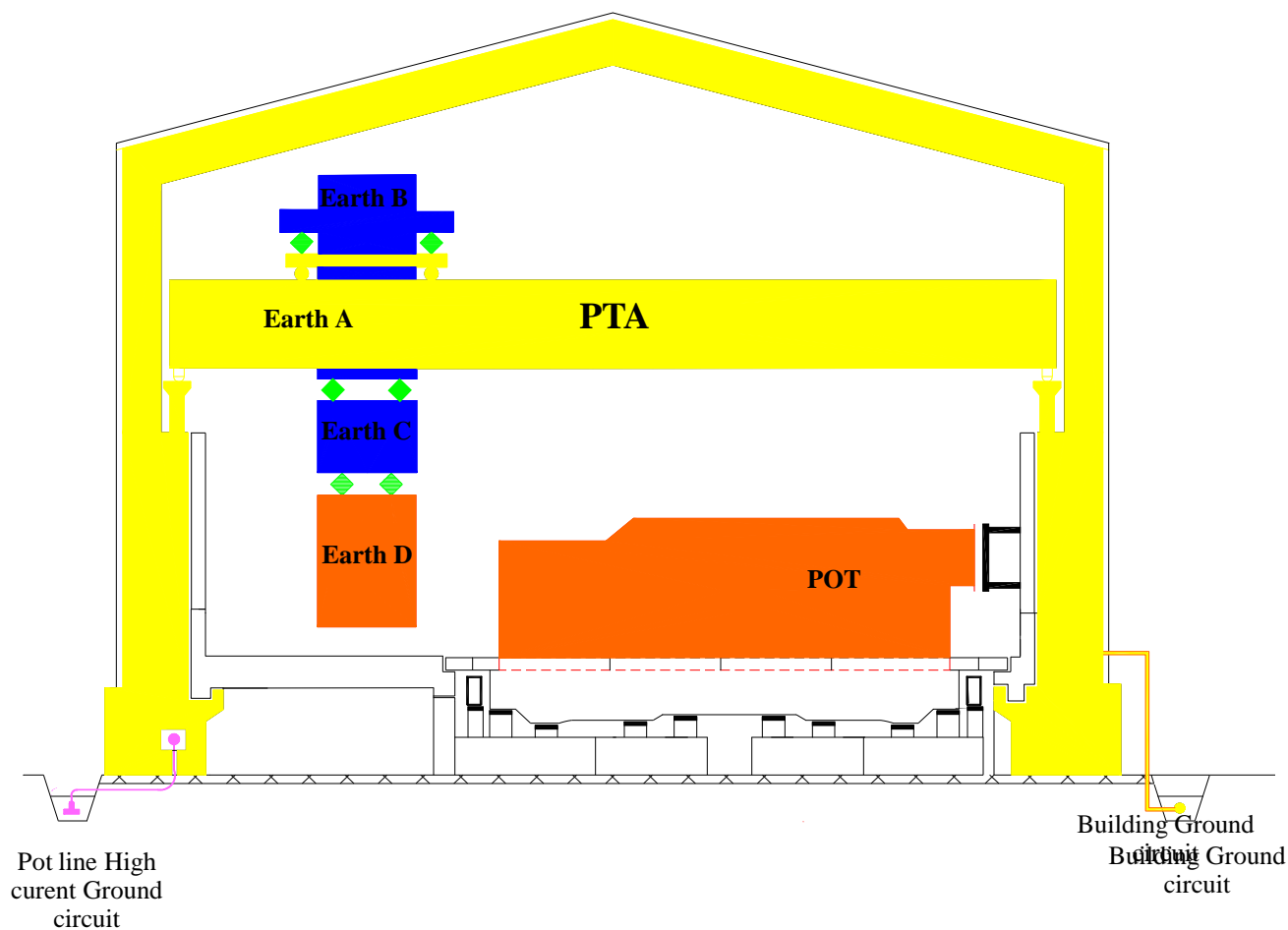
What about the potline cranes? Insulation monitoring CPI-s

A common potline is 360 pots in series energised by a source of power that can reached more than 390KA under 1512VDC.

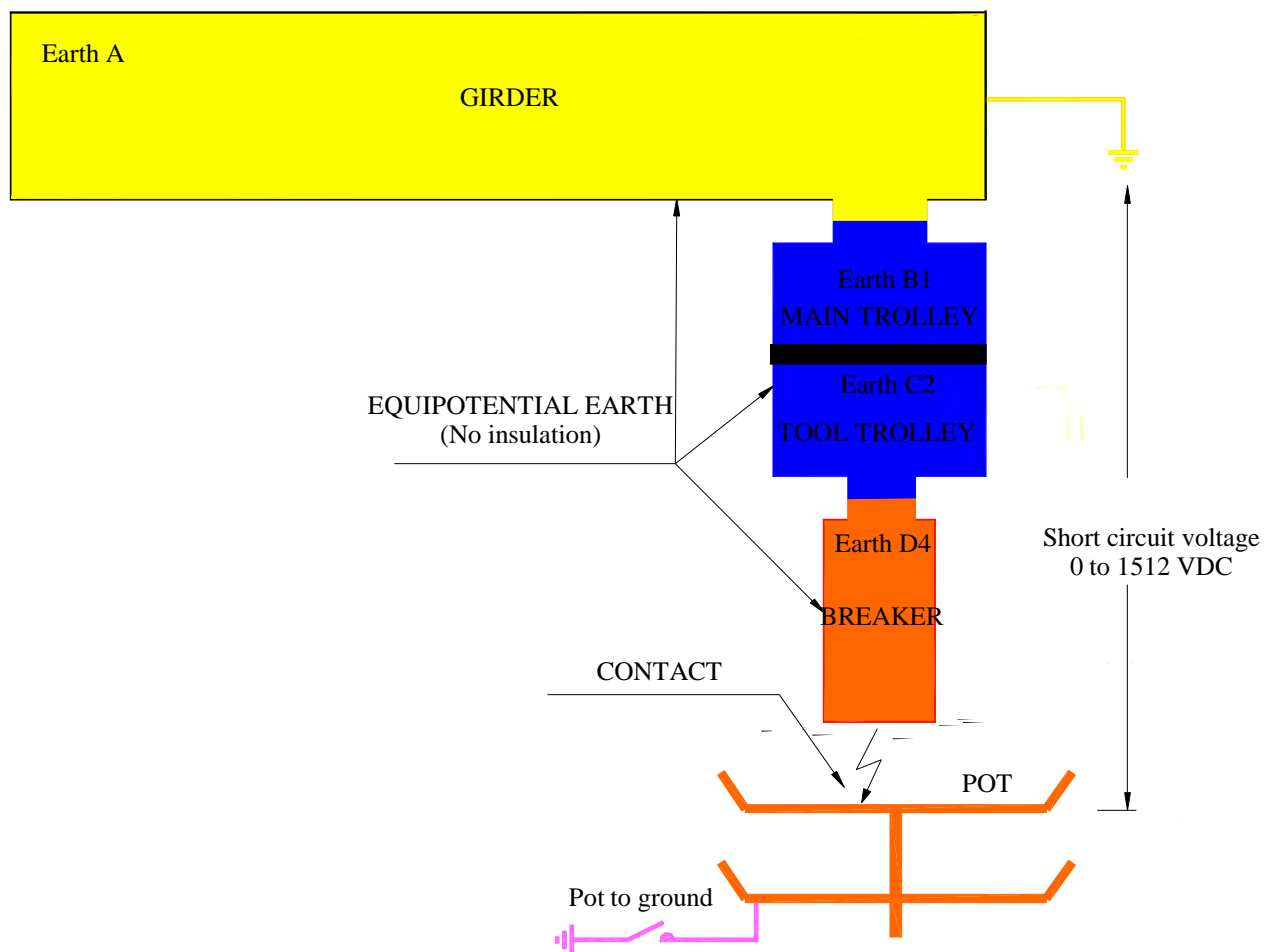
The ground can be moved, therefore the crane can be in contact with a difference of potential of 1512VDC between A (endtrucks, girders) and D (tools)



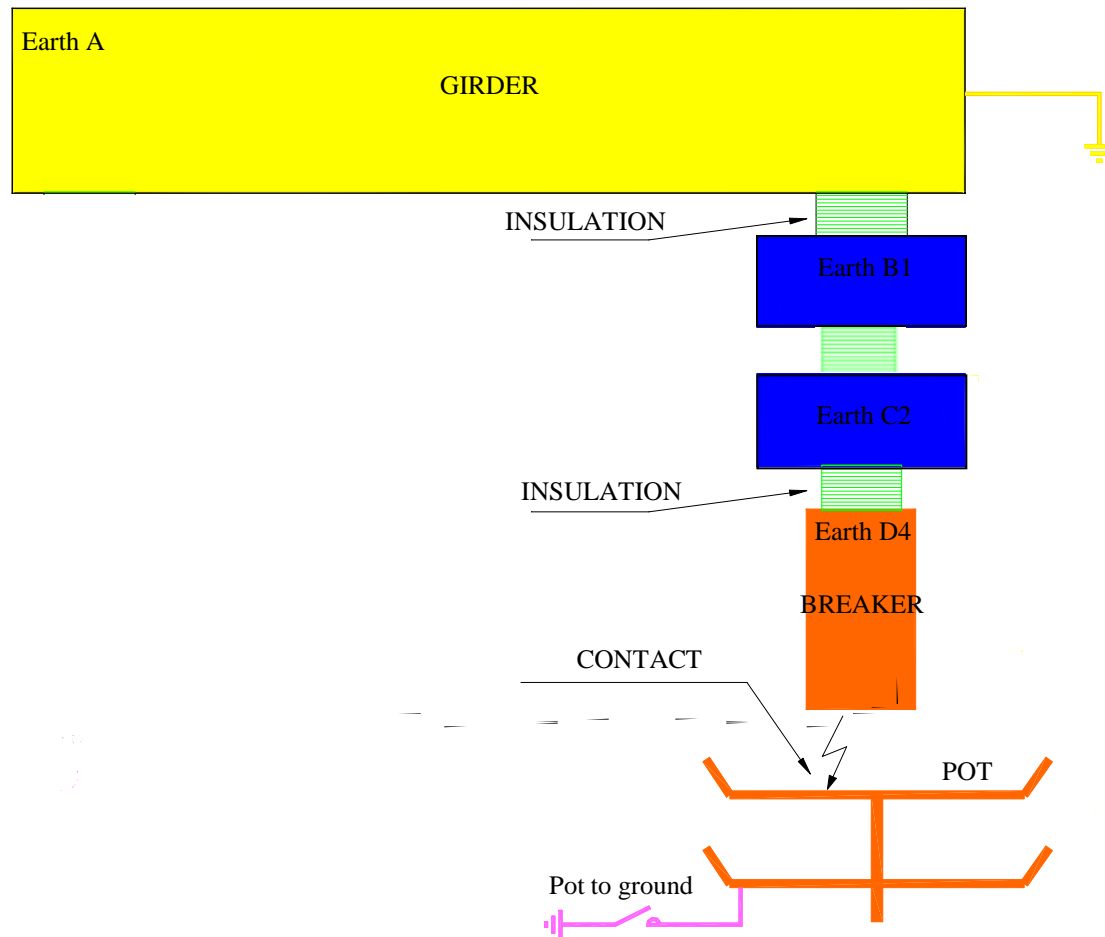
Potline Building Section



PTA Without Insulation

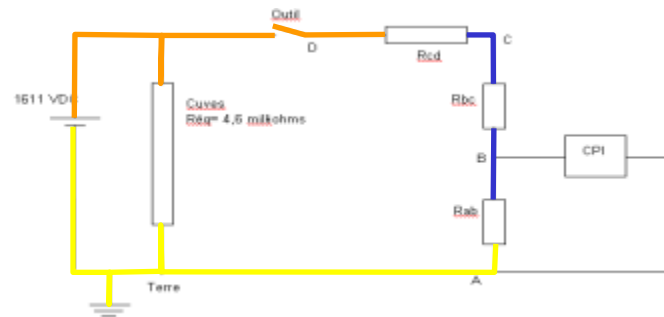


PTA With Insulation



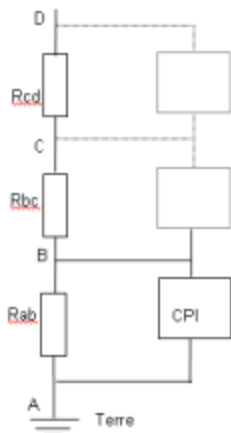
What about the potline cranes? Insulation monitoring cpi-s

In the case of the installation of a CPI-s installed to monitor the resistance between A and B, the resistance that it might see might differ depending on whether or not the crane is in contact with the pot:

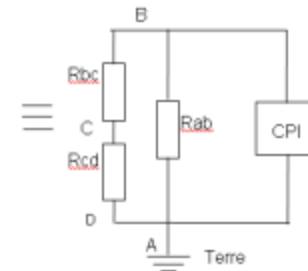
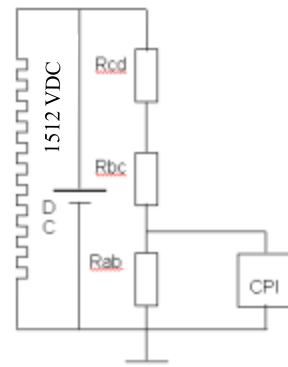
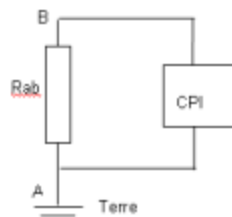


Scenario 1: Tool not in contact with pot

Scenario 2: Tool in contact with pot



≡



In this case the pot impedance is considered negligible against the other resistances

Cpi-s monitoring devices Importance of cabling

The CPI-s usually do a sequential monitoring of the insulation level through the use of a flip-flop. The timer is set at 60 seconds.

The CPI-s are installed in a specifically designed insulated box. We call this box SILVER™.

The new CPI must have 2 measuring cables in order to use the “loose connection auto control” feature.

It is important to ensure a good connection between the CPI-s and the levels to monitor. (Insulated Cable 2 000 Vdc 2 x 2,5 mm²)

Cpi-s monitoring devices Fault and alarm

The CPI-s has 2 thresholds:

- an « **ALARM** », set at **1,3 MOhms**. (= 2 mA) Shall inform the operator of the insulation deficiency by means of flashing lamps on the girder and alarm message on the panel view.
- a « **DEFAULT** », set at **200 kOhms**. (= 10 mA) Shall inform the operator of the insulation fault by means of flashing lamps on the girder and fault message on the panel view. **All motions are in low speed.**

A problem that is detected by a CPI is to be considered IMMEDIATELY and maintenance shall be called to correct the problem. All tools must be taking out from the pot and PTM must be store in a repair area.

The fault or alarm should be addressed only by a competent person aware of the hazards (and trained). Particular attention must be taken and risk assessed if the crane is still in contact with the pot. In that particular case, access should be authorized once the pot has been « **earthed** » properly. (MALT)

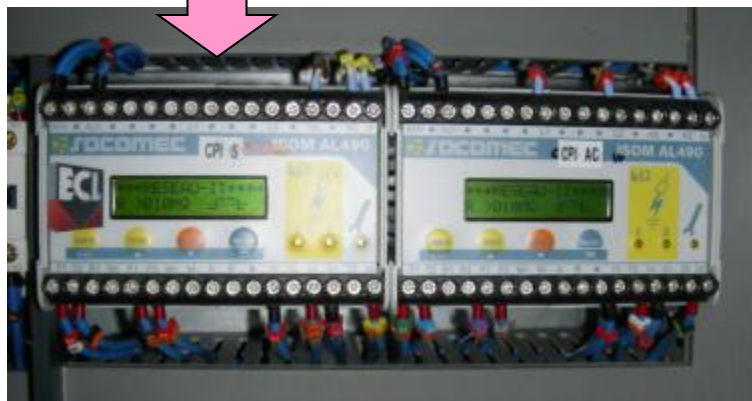
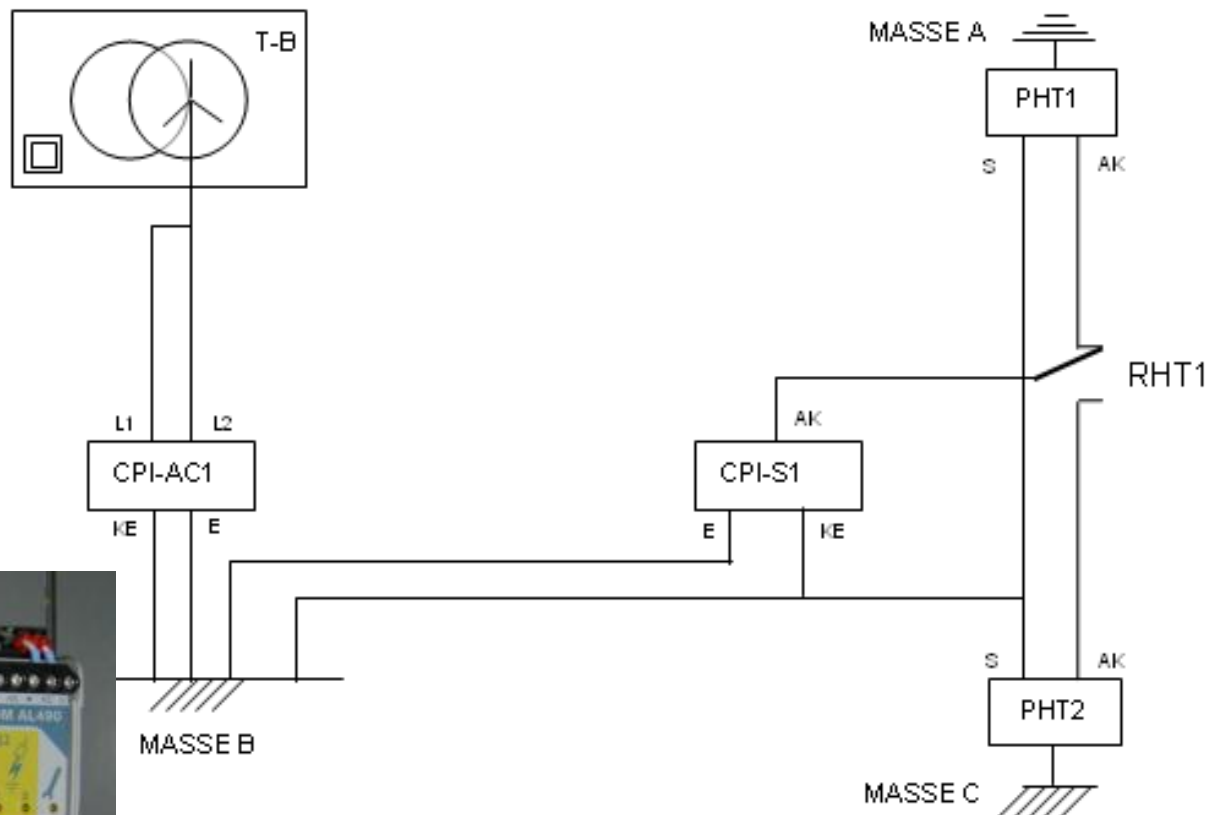
Insulation Monitoring Cpi-s

ADJUSTING VALUE:

FAULT : 200 kOhms

ALARM : 1 300 kOhms

Flip Flop Switch = 1mn



Insulation monitoring cpi-s Setting value

SETTING VALUE:

Alarm1 : 1,3MΩ

Alarm2 : 200kΩ

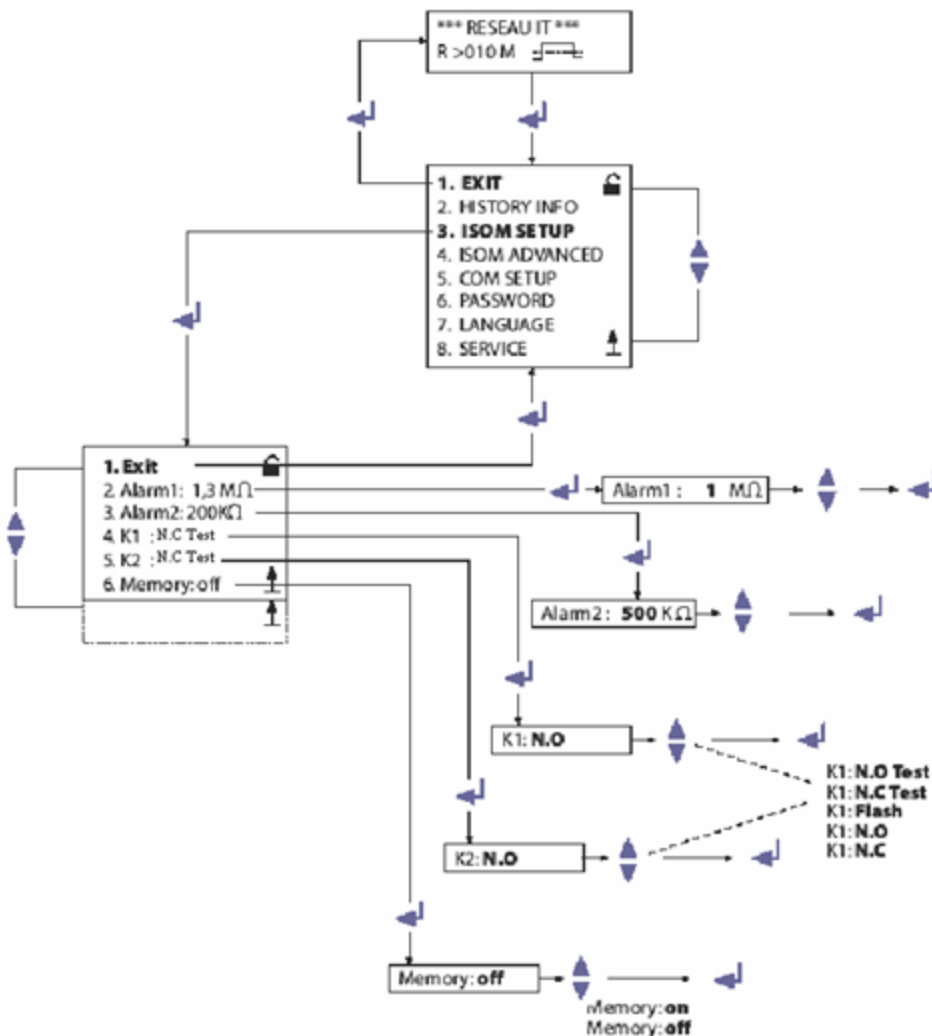
K1 : N.C Test

K2 : N.C Test

Memory : off

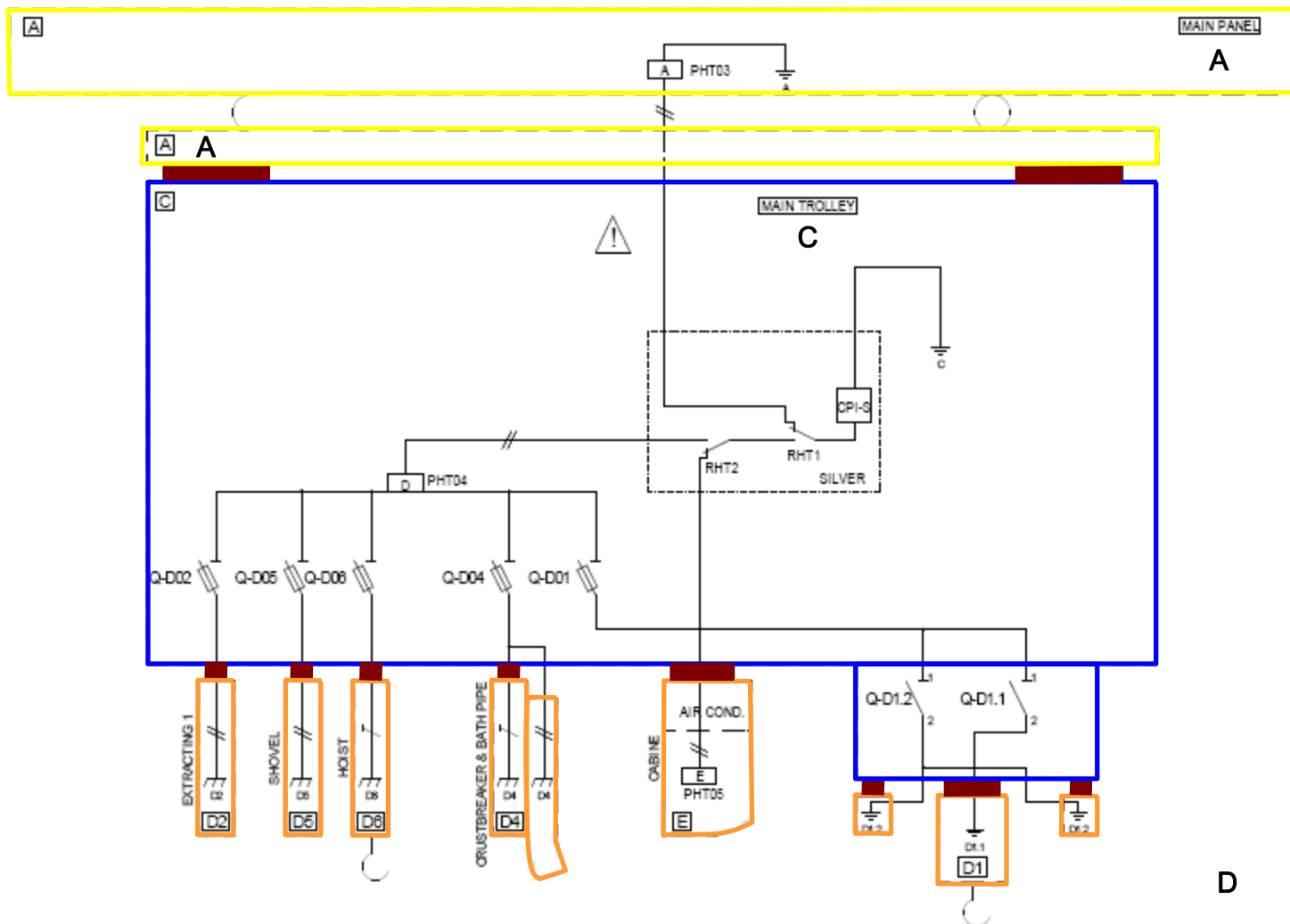
Auto-test : 1h

Principe de mesure : AMP

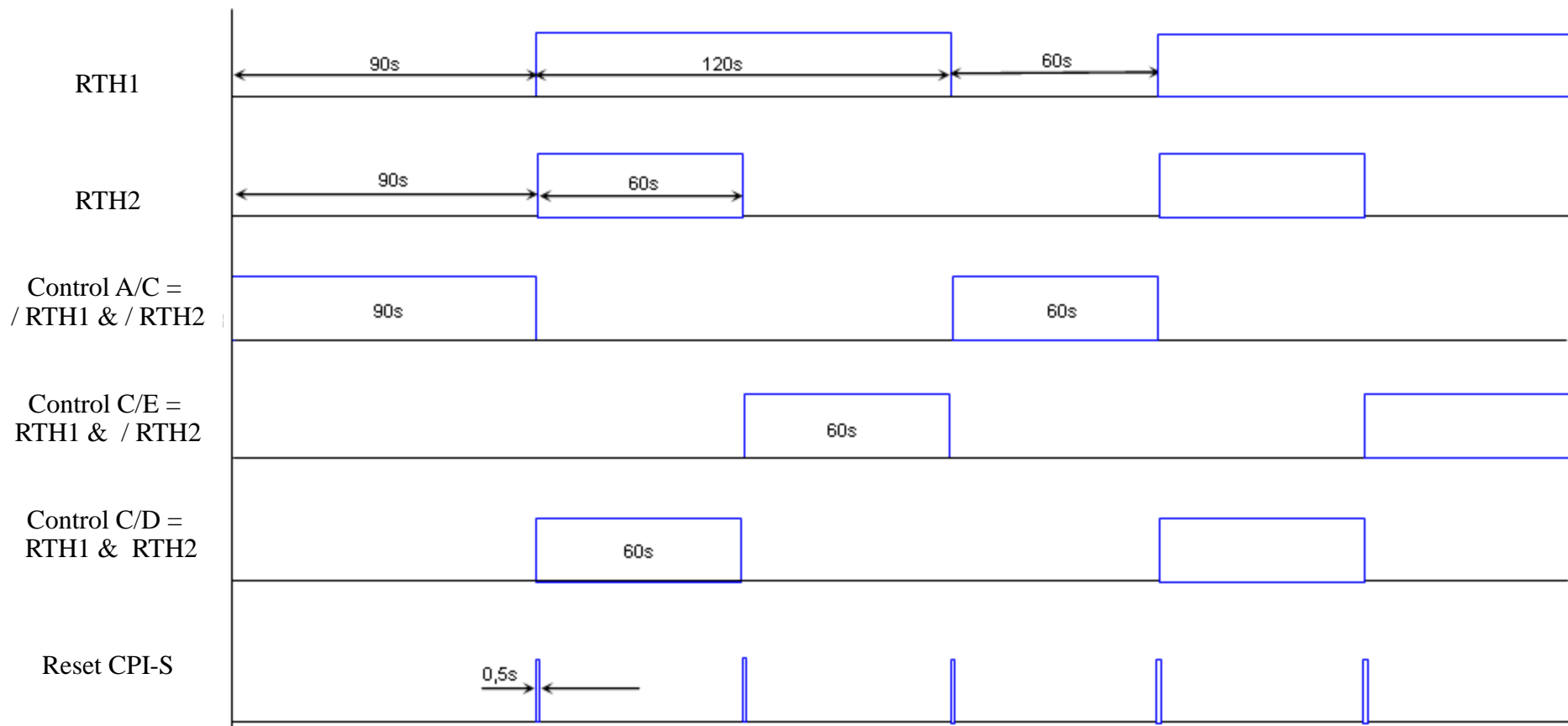


Cpi-s monitoring devices

Pta control



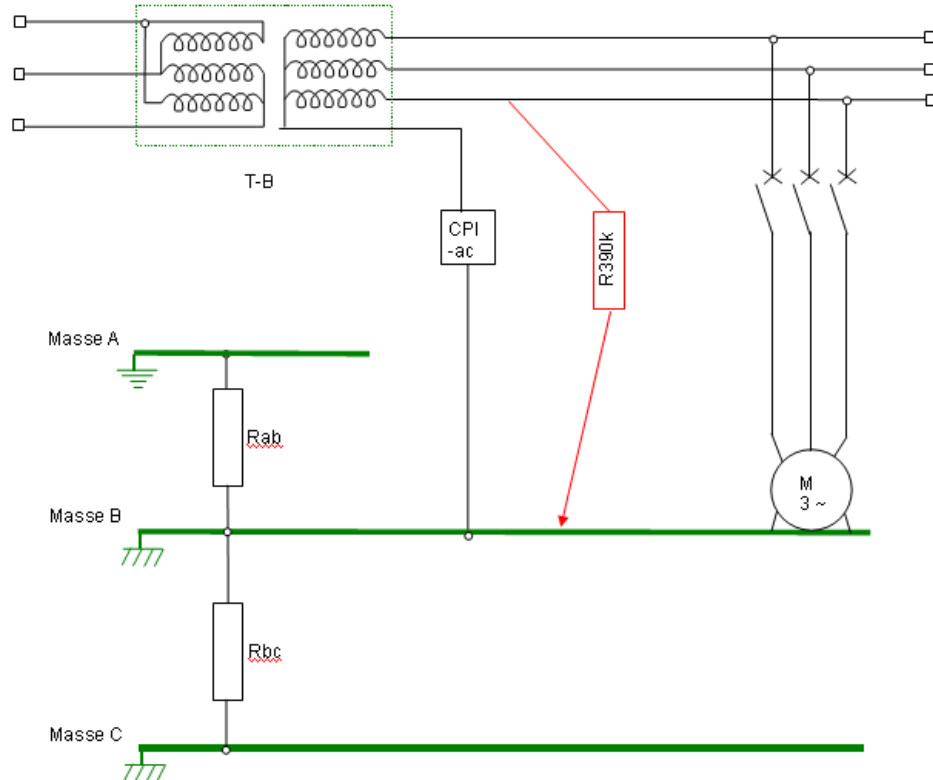
Cpi-s monitoring devices Control sequence



Cpi-ac monitoring devices

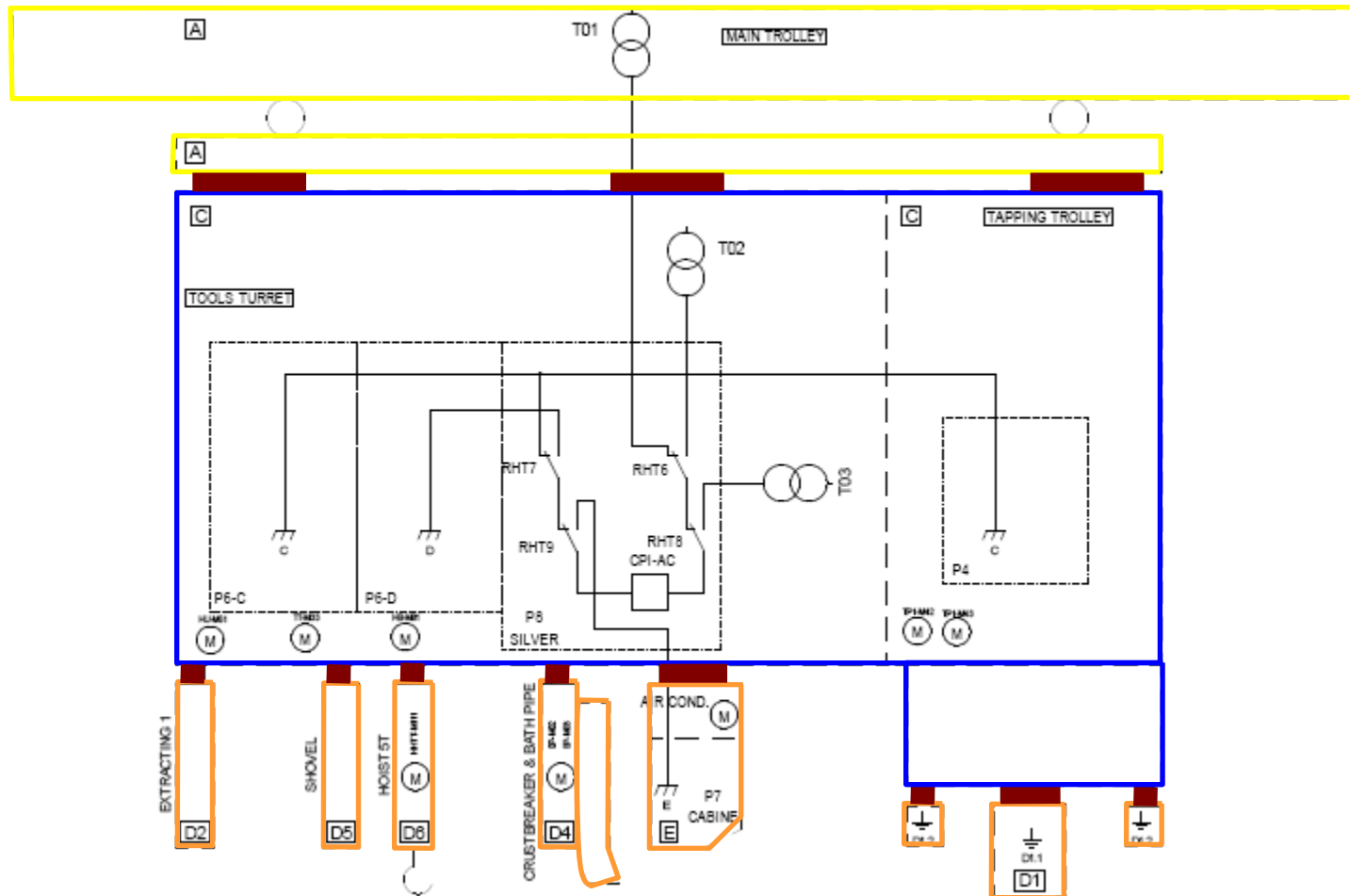
Purpose (Power leakage)

All actuators not on the A ground must be energized through an insulated transformer from the A ground. The CPI-ac monitors the insulation of any of the actuators. Should one of them fail, then the CPI-ac will detect the fault as soon as it is energized. As some of the actuators can be energized for a couple of seconds only, it is important that the CPI-ac has a quick response time and constantly monitor the actuators.

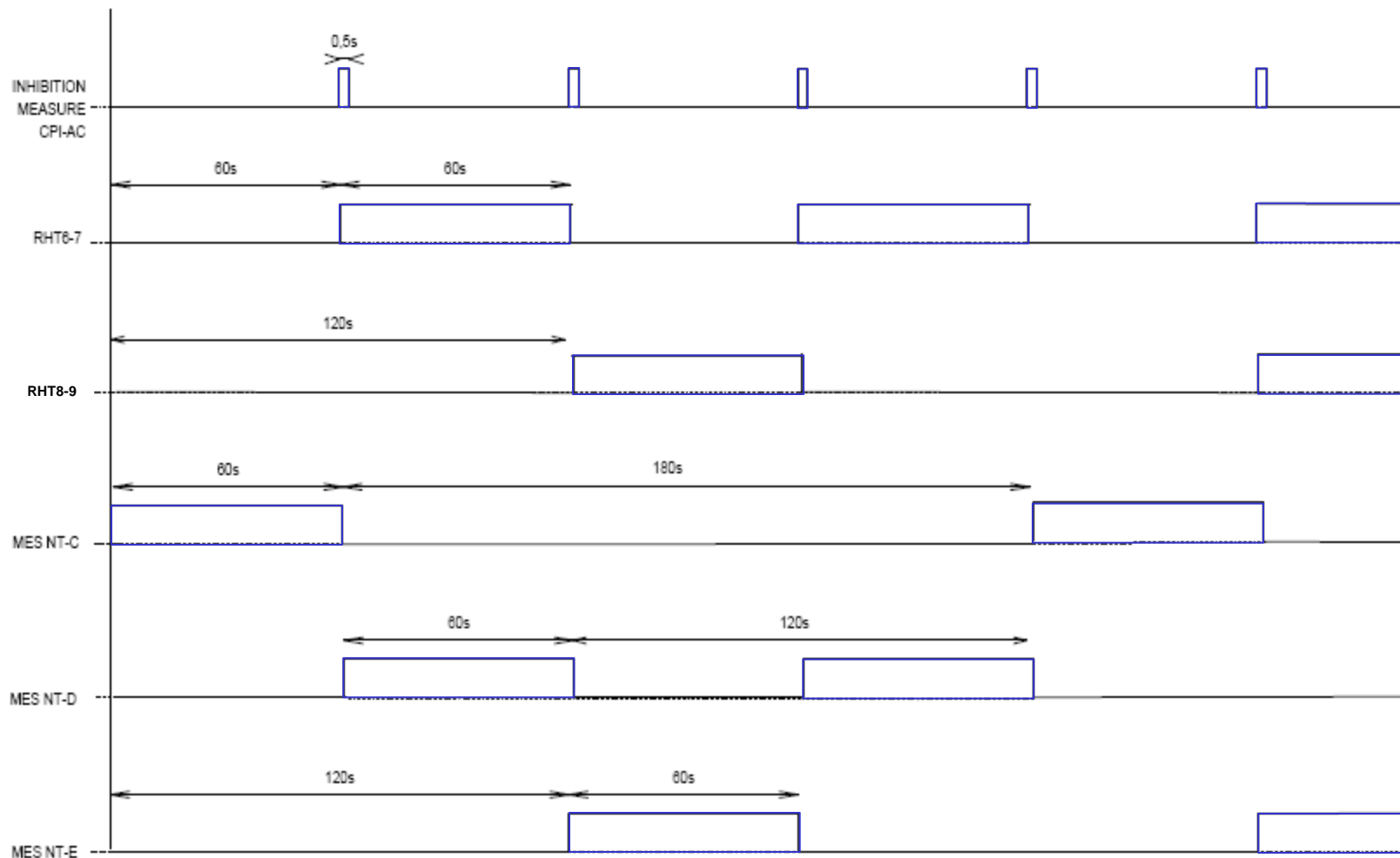


Cpi-ac monitoring devices

Purpose



Cpi-ac monitoring devices Control sequence



Cpi-ac monitoring devices Setting value

SETTING VALUE:

Alarm1 : 500k Ω

Alarm2 : 500k Ω

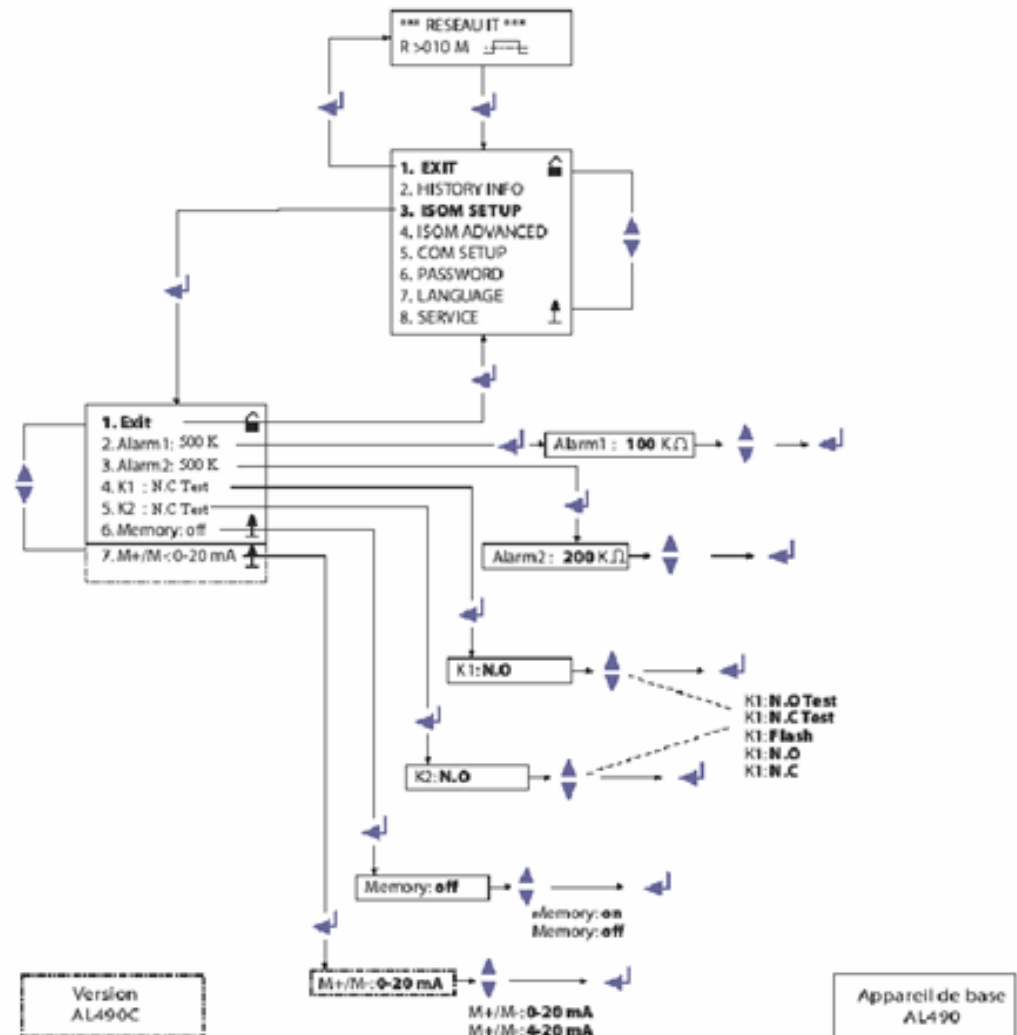
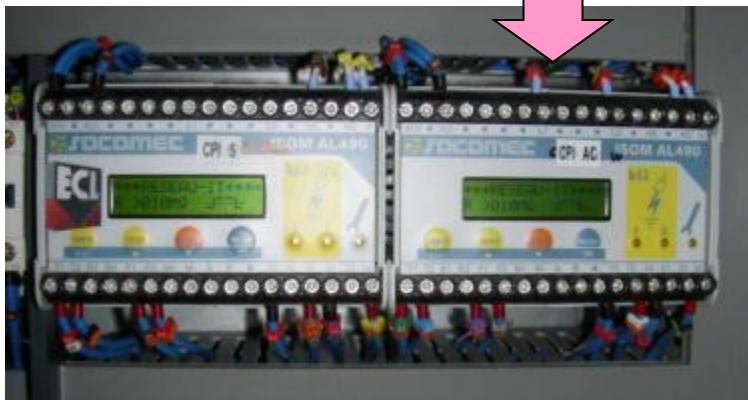
K1 : N.C Test

K2 : N.C Test

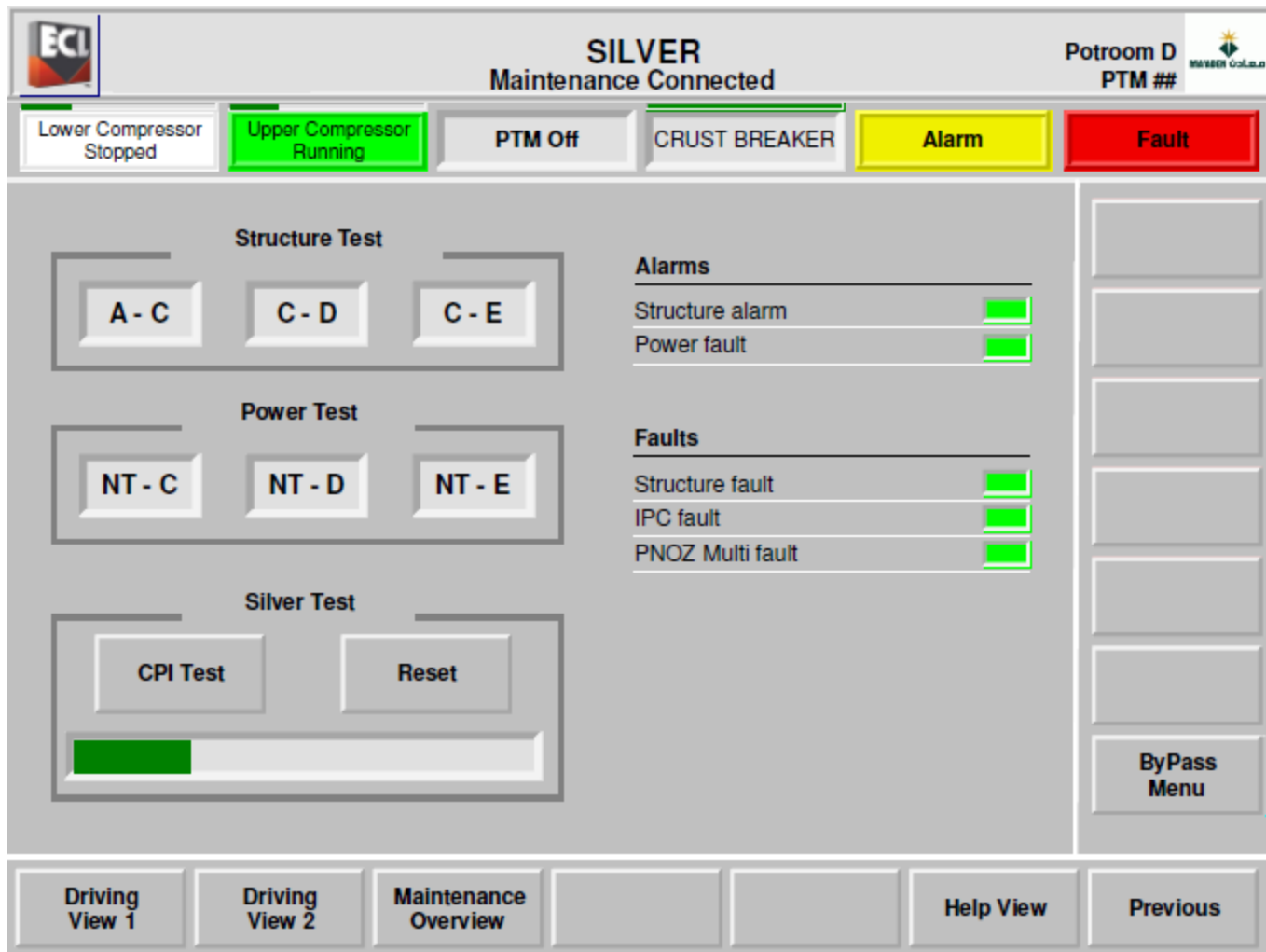
Memory : off

Auto-test : 1h

Principe de mesure : AMP



Insulation monitoring devices HMI



SILVER
Maintenance Connected

Potroom D
PTM #

Lower Compressor Stopped **Upper Compressor Running** PTM Off CRUST BREAKER **Alarm** **Fault**

Structure Test

A - C C - D C - E

Power Test

NT - C NT - D NT - E

Silver Test

CPI Test Reset

Alarms

Structure alarm ☒

Power fault ☒

Faults

Structure fault ☒

IPC fault ☒

PNOZ Multi fault ☒

ByPass Menu

Driving View 1 Driving View 2 Maintenance Overview Help View Previous

Insulation monitoring devices

Panel layout



Insulation monitoring devices

Panel Interface

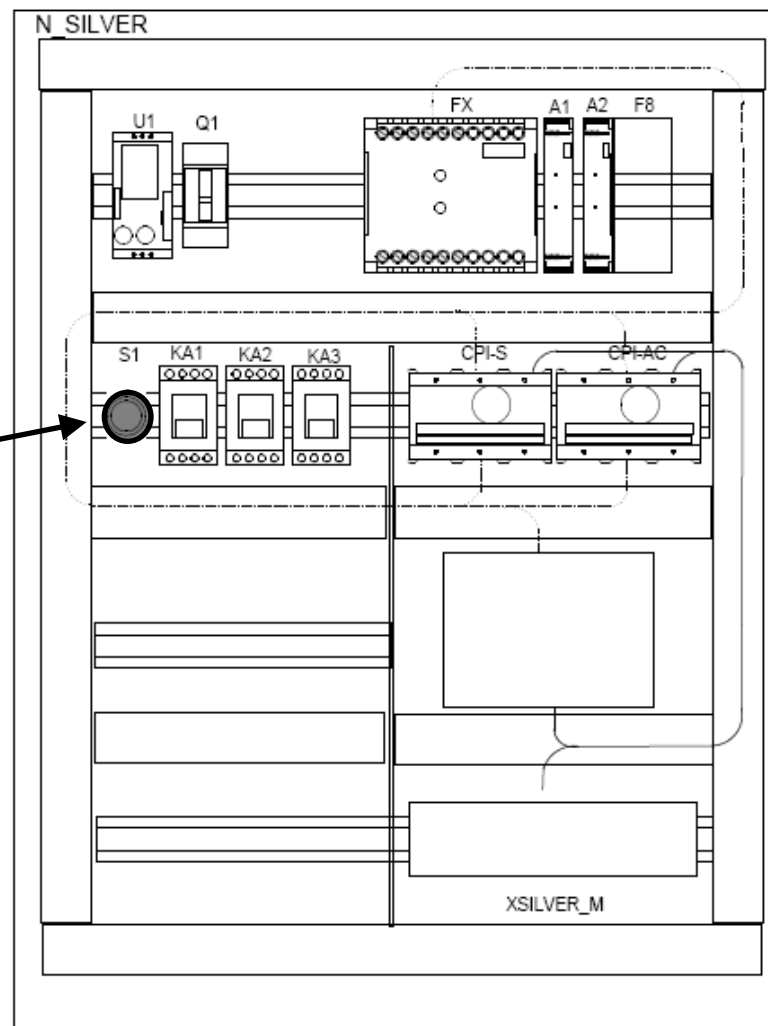
- Insulation fault location will be carried out from the insulation junction box.
 - On the insulation junction box :
 - Green lamps indicate test location :
STRUCTURE A/B or B/C or B/D or NT/B or NT/C
 - Red lamps indicate the fault type :
POWER or STRUCTURE or PNOZE or CPI
 - Orange lamps indicate the STRUCTURE Alarm
- An electronic timer automatically changes the insulation test from A/B to B/C to B/D every minute. The green lamps are respectively lit and turned off at each change.
- A manual insulation detection can be activated by the operator using the push button TEST «A/B» or «B/C» or «B/D» or «NT/B» or «NT/C», the green lamps indicate the selected test. The test will run during 10 min.



Insulation monitoring devices

Panel layout

To reset the structure fault memory
or a Power fault memory,
maintenance technical must press S1
push button



Trouble shooting

Main fault

1. Water and humidity inside the compress air circuit.
 - Check if there is low point in the circuit
 - Verify the efficiency of the water separator system
 - Verify the efficiency of the air dryer
 - Verify the purge sequences
2. Electrical component failure
 - Verify the electrical apparatus (LS, SV, motors, sensors, ...)
 - Verify the connections of the electrical apparatus
 - Verify the connections inside the electrical panel
 - Verify the power & control cable
3. Mechanical Insulation fault
 - Clean the insulator (dust, grease, ...)
- Remove all un-necessaries part (bolts, welding rod, tools, ...)

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

MA'ADEN project

P1034

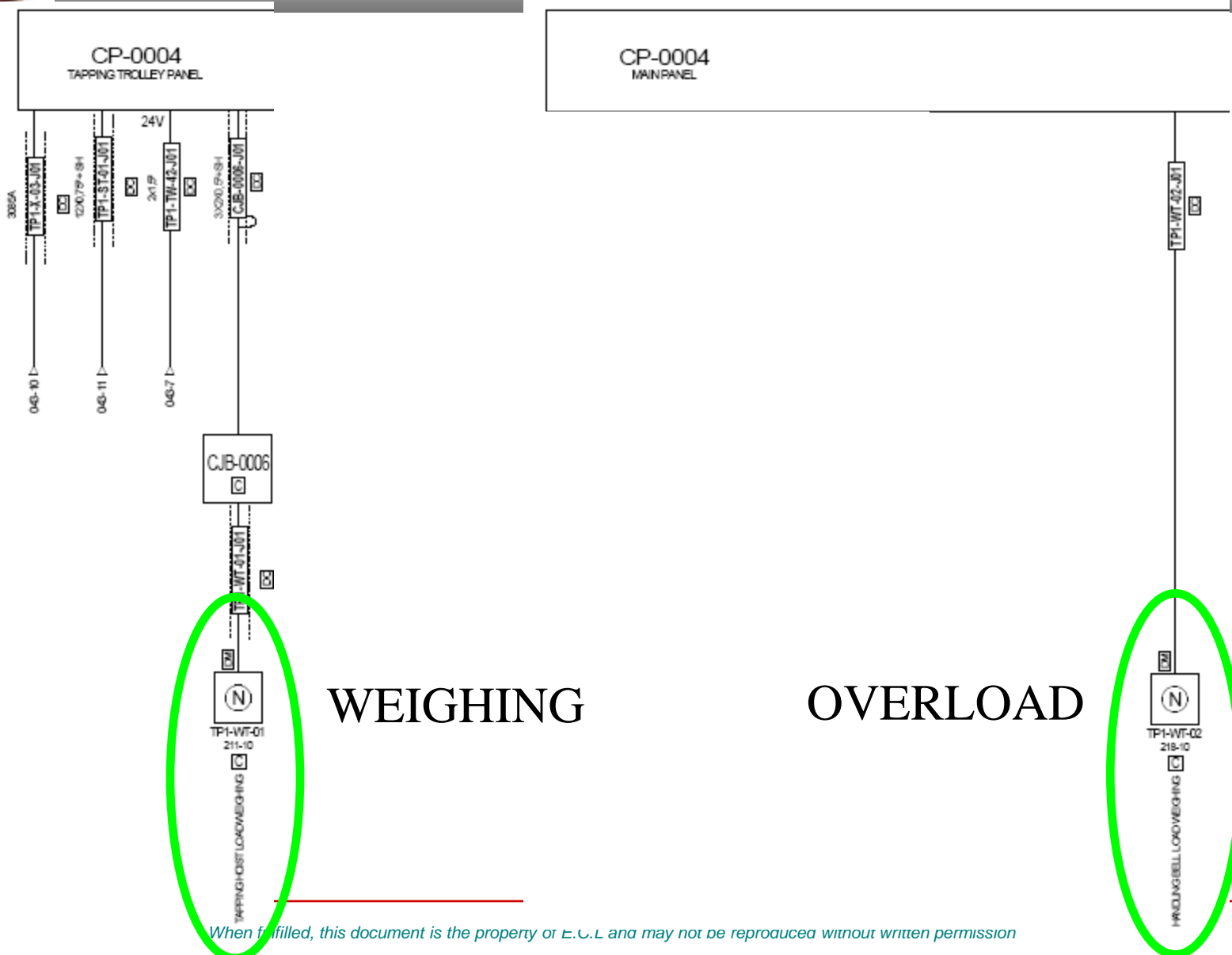
PTA - POT TENDING ASSEMBLY

**WEIGHING SYSTEM
on Tapping Hoist**

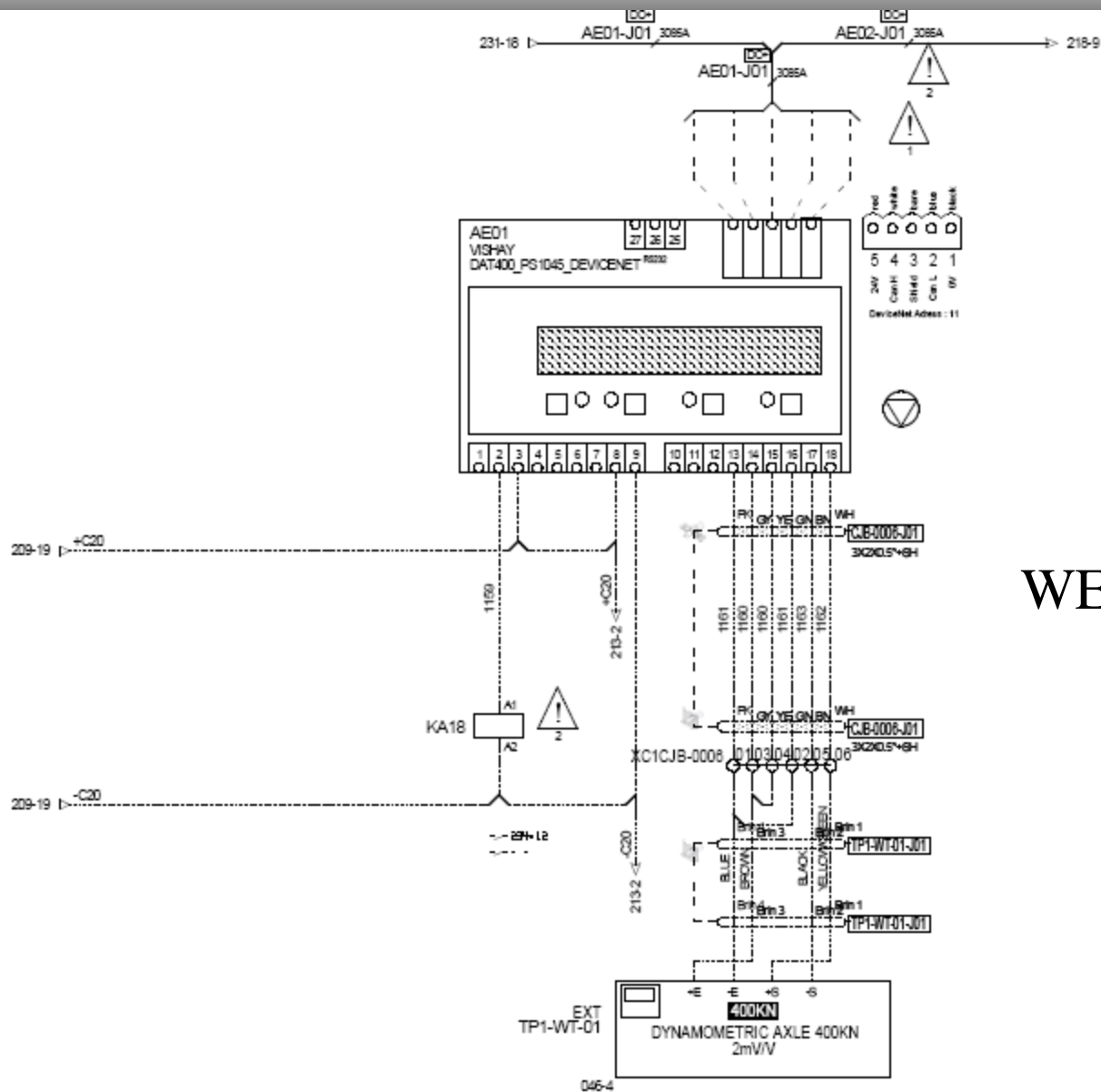
INTEGRATED SYSTEM



INTEGRATED SYSTEM



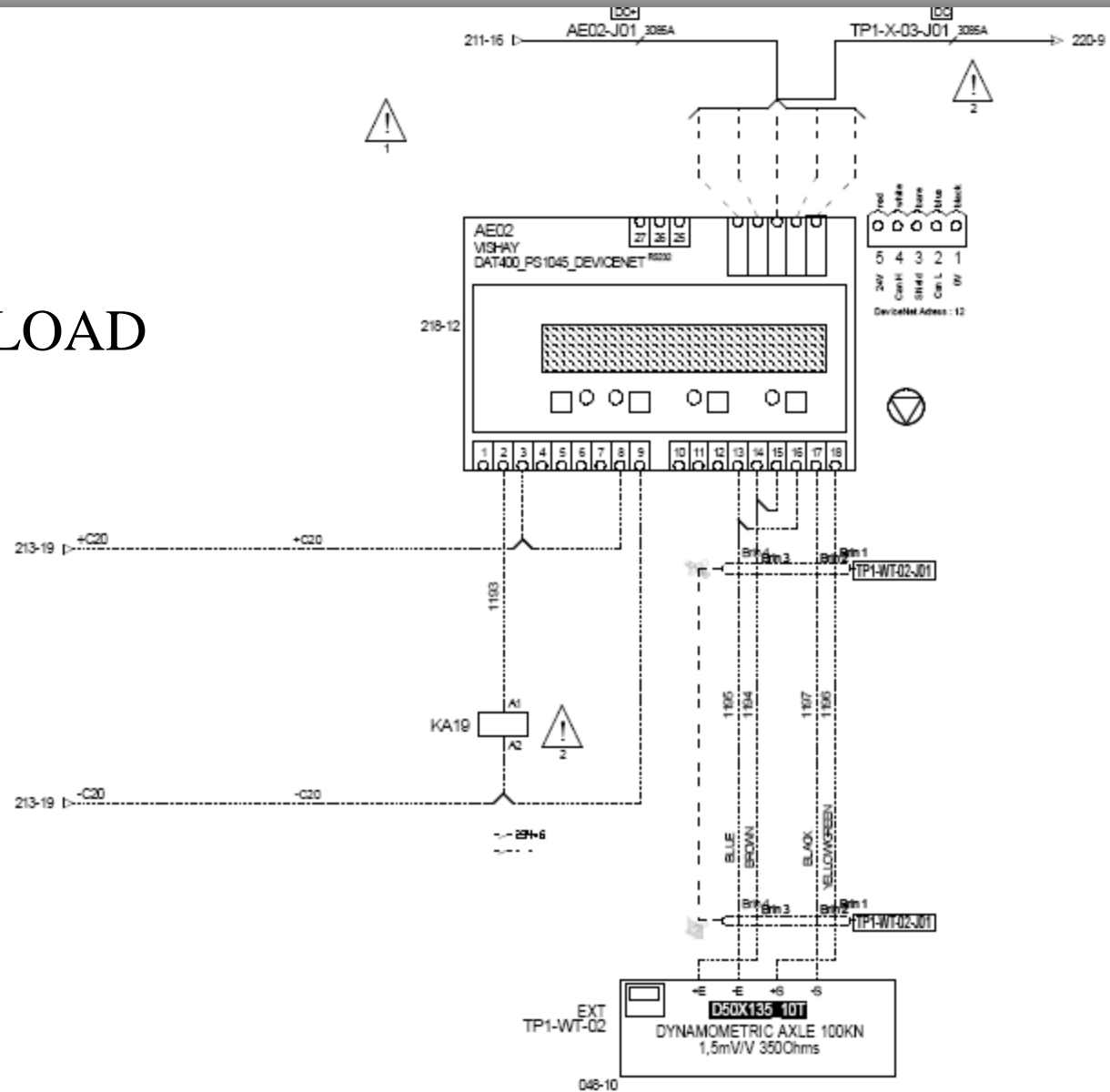
INTEGRATED SYSTEM



WEIGHING

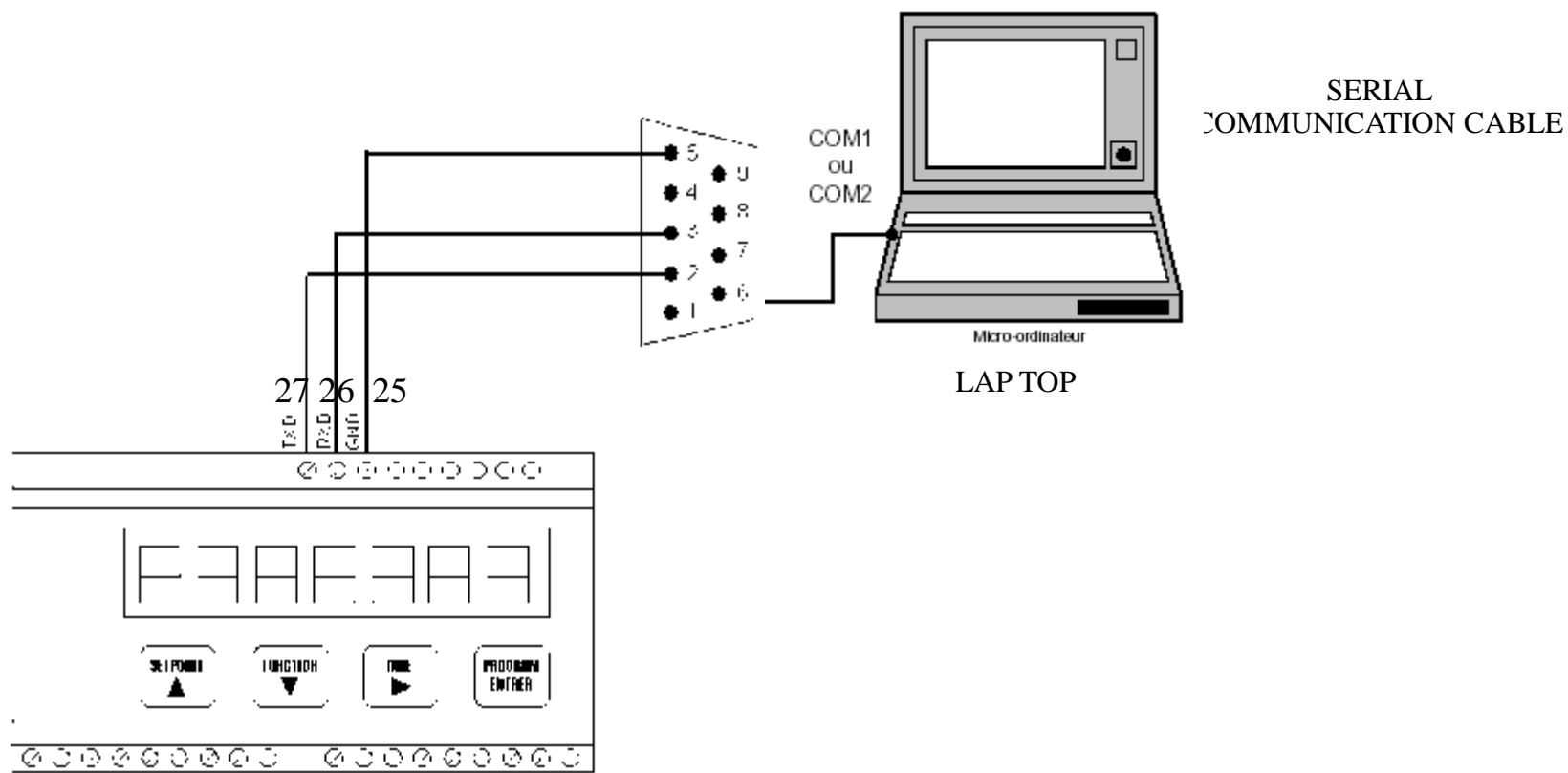
INTEGRATED SYSTEM

OVERLOAD



LAPTOP CONNECTION FOR SETTING

1. Connect the PC to the VISHAY DAT400



VISHAY MODULE IN REMOTE MODE

Pro view v3.1

Set the Vishay module in remote mode.

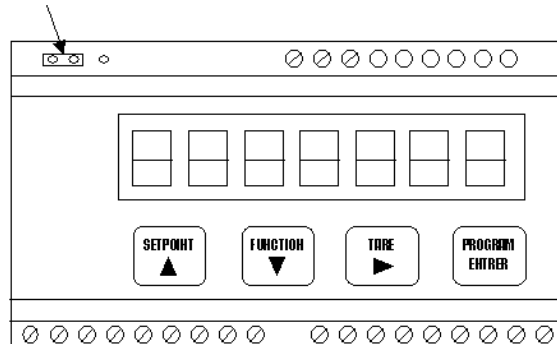
First Way:

- On the Vishay DAT400 module, press the buttons **PROGRAM** & **SETPOINT** in same time until the menu appear (beginning with PROGRAM Button)
- With the arrows **↑↓** select **SERIAL** and press **ENTER**
- With the arrows **↑↓** select **REM-CO** and press **ENTER**
- The module is in remote mode and can exchange data with the PC (Software Proview)

OR

Second Way :

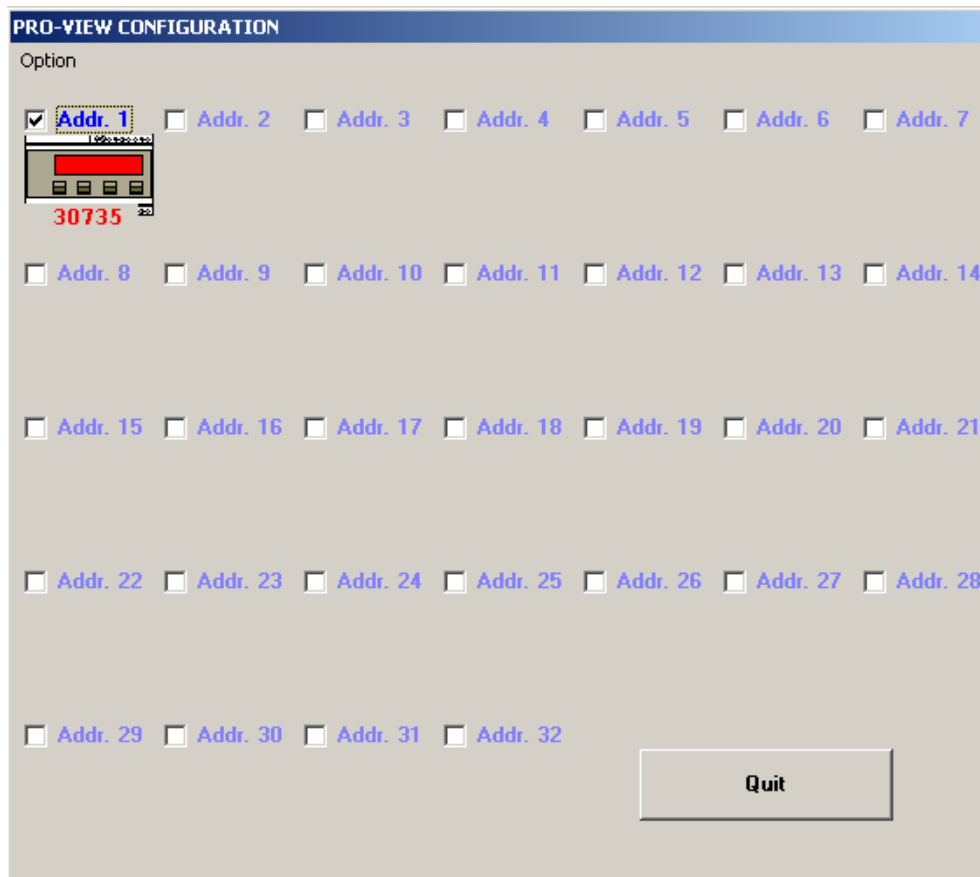
- Move the dip switch on the right:



Start Pro view V3.1

START THE SOFTWARE PRO VIEW V3.1

This page appear (if there is a communication problem, the message ERROR will be indicated):



The image shows a software configuration window titled "PRO-VIEW CONFIGURATION". It contains a section labeled "Option" with a list of 32 addresses, each preceded by a checkbox. Address 1 is selected, and a small window is overlaid on its checkbox showing a red bar and the number "30735". The addresses are arranged in five rows: Row 1 (Addr. 1 to 7), Row 2 (Addr. 8 to 14), Row 3 (Addr. 15 to 21), Row 4 (Addr. 22 to 28), and Row 5 (Addr. 29 to 32). A "Quit" button is located at the bottom right of the window.

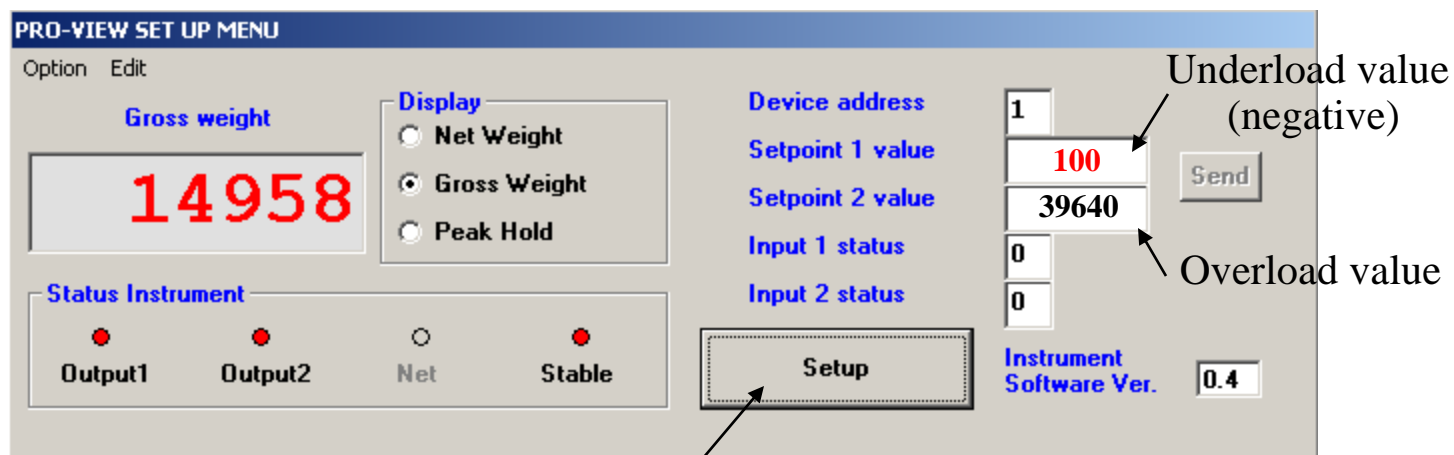
Option
<input checked="" type="checkbox"/> Addr. 1
<input type="checkbox"/> Addr. 2
<input type="checkbox"/> Addr. 3
<input type="checkbox"/> Addr. 4
<input type="checkbox"/> Addr. 5
<input type="checkbox"/> Addr. 6
<input type="checkbox"/> Addr. 7
<input type="checkbox"/> Addr. 8
<input type="checkbox"/> Addr. 9
<input type="checkbox"/> Addr. 10
<input type="checkbox"/> Addr. 11
<input type="checkbox"/> Addr. 12
<input type="checkbox"/> Addr. 13
<input type="checkbox"/> Addr. 14
<input type="checkbox"/> Addr. 15
<input type="checkbox"/> Addr. 16
<input type="checkbox"/> Addr. 17
<input type="checkbox"/> Addr. 18
<input type="checkbox"/> Addr. 19
<input type="checkbox"/> Addr. 20
<input type="checkbox"/> Addr. 21
<input type="checkbox"/> Addr. 22
<input type="checkbox"/> Addr. 23
<input type="checkbox"/> Addr. 24
<input type="checkbox"/> Addr. 25
<input type="checkbox"/> Addr. 26
<input type="checkbox"/> Addr. 27
<input type="checkbox"/> Addr. 28
<input type="checkbox"/> Addr. 29
<input type="checkbox"/> Addr. 30
<input type="checkbox"/> Addr. 31
<input type="checkbox"/> Addr. 32

Quit

Double clicks on Address 1

SETUP MENU

Setting for TP1-WT-01 / AE01 module (weighing)



The image shows a 'PRO-VIEW SET UP MENU' interface. It features a large digital display showing '14958' in red. To the right of the display are three radio buttons for 'Display' mode: 'Net Weight', 'Gross Weight' (selected), and 'Peak Hold'. Below the display are four status indicators: 'Output1' (red dot), 'Output2' (red dot), 'Net' (white circle), and 'Stable' (red dot). To the right of these are labels for 'Device address', 'Setpoint 1 value', 'Setpoint 2 value', 'Input 1 status', and 'Input 2 status'. A 'Send' button is located to the right of the setpoint values. Below the 'Send' button are three input fields: '1', '100', and '39640'. An arrow points from the text 'Underload value (negative)' to the '100' field, and another arrow points from 'Overload value' to the '39640' field. At the bottom right, there is a label 'Instrument Software Ver.' and a field showing '0.4'. A 'Setup' button is located at the bottom center of the interface, with an arrow pointing to it from the text 'Press Setup to access to the Setup menu' below the image.

PRO-VIEW SET UP MENU

Option Edit

Gross weight

14958

Status Instrument

Output1 Output2 Net Stable

Display

☐ Net Weight
☒ Gross Weight
☐ Peak Hold

Device address

Setpoint 1 value

Setpoint 2 value

Input 1 status

Input 2 status

1 100 39640

Send

Underload value (negative)

Overload value

Instrument Software Ver. 0.4

Setup

Press Setup to access to the Setup menu

SETUP MENU

Setting for TP1-WT-01 / AE01 module (weighing)

Load cell Setup

PRO-VIEW SET UP MENU

Option Edit

Gross weight

480

Status Instrument

Output1 Output2 Net Stable

Display

☐ Net Weight
☒ Gross Weight
☐ Peak Hold

Device address 1

Setpoint 1 value 100

Setpoint 2 value 39600

Input 1 status 0

Input 2 status 0

Exit Setup

Instrument Software Ver. 0.4

Configuration Calibration Parameters Relay Outputs Serial Analog Test

Total capacity of transducers (CAPAC) 40 000

Full scale output value (mV/V) (SENSIT) 2.0000

Net weight (value) (NET) 40 000

Dead load (value) (DEAD L) 0

Display resolution (DSPDIV) 5

Input signal (mV/V) (Reference only) (SIGNAL)

Internal counts (Reference only) (COUNTS)

Operating mode (OPMODE)

New Configuration

Send

Send

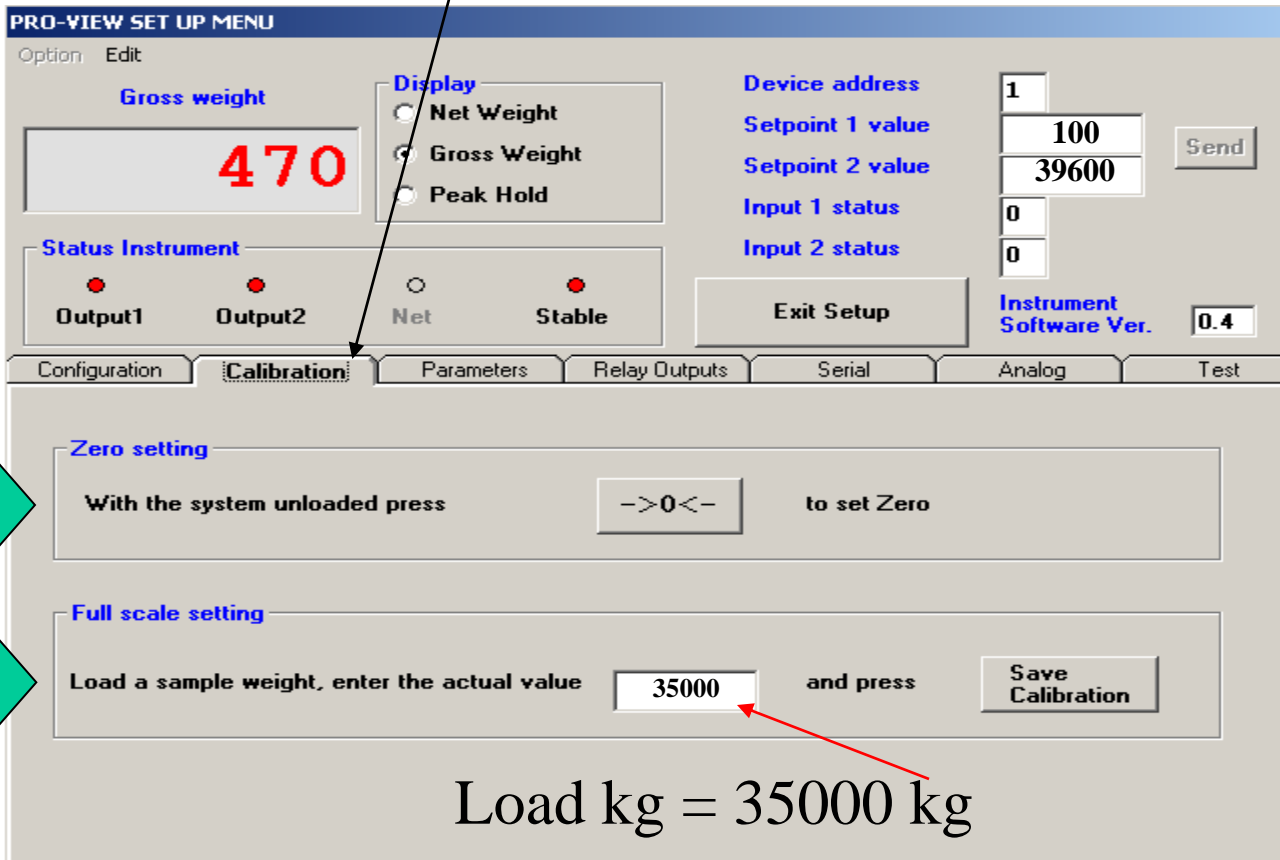
Send

Send

CALIBRATION

Setting for TP1-WT-01 / AE01 module (weighing)

Calibration



PRO-VIEW SET UP MENU

Option Edit

Gross weight

470

Status Instrument

Output1 Output2 Net Stable

Display

Net Weight Gross Weight Peak Hold

Device address

1

Setpoint 1 value

100

Setpoint 2 value

39600

Input 1 status

0

Input 2 status

0

Exit Setup

Instrument Software Ver.

0.4

Configuration **Calibration** Parameters Relay Outputs Serial Analog Test

Zero setting

With the system unloaded press →0← to set Zero

Full scale setting

Load a sample weight, enter the actual value 35000 and press Save Calibration

Load kg = 35000 kg

1. Lift the hook empty and press →0← to calibrate the ZERO
2. Lift the knowledge mass, enter the value in kg and validate with Save Calibration button

RELAY OUTPUTS SETUP

Setting for TP1-WT-01 / AE01 module (weighing)

Relays Setup

PRO-VIEW SET UP MENU

Option Edit

Gross weight

470

Display

☐ Net Weight

☒ Gross Weight

☐ Peak Hold

Device address 1

Setpoint 1 value 200

Setpoint 2 value 39600

Input 1 status 0

Input 2 status 0

Status Instrument

☒ Output1 ☒ Output2 ☐ Net ☒ Stable

Exit Setup

Instrument Software Ver. 0.4

Configuration Calibration Parameters **Relay Outputs** Serial Analog Test

Operating mode

Contact status below setpoint value

Positive / Negative weight comparison

Immediate activation / Activation after stabilization

Hysteresis (default 2)

Setpoint activation time length (in 1/10 sec.) (0 = disable)

Time delay for activating setpoint (in 1/10 sec.) (0 = disable)

(MODE)

Output 1

Gross

N.C

Negative

Normal

Output 2

Gross

N.C

Positive

Normal

(HYST) 10

(TIMER) 0

(DELAY) 0

Send

MANUAL SETUP

Setting for TP1-WT-01 / AE01 module (weighing)

DESCRIPTION OF THE FRONT PANEL OF THE VISHAY TRANSDUCER.



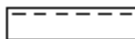
COMPLETE CONFIGURATION MENU OF THE VISHAY TRANSDUCER.

PLACE THE UNIT IN COMPLETE CONFIGURATION MODE BY

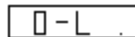
PRESSING AND HOLDING THE  AND  KEYS. THE  KEY MUST BE PRESSED AFTER  KEY.

RELEASE THE  AND  KEYS WHEN **CONFIG** IS DISPLAYED.

ERROR MESSAGES.

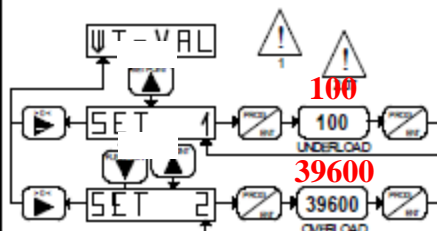


- THE WEIGHT DISPLAYED BY THE INSTRUMENT IS MORE THAN 9 DIVISIONS OVER THE "LIVE" WEIGHT VALUE.



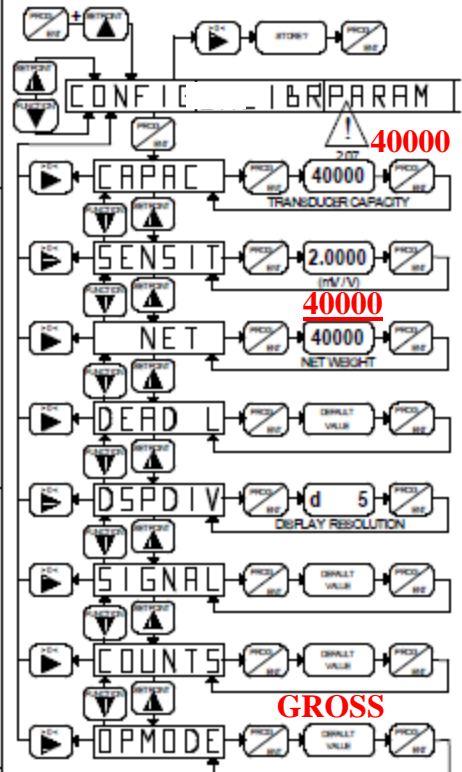
- THE LOAD CELLS INPUT SIGNAL IS LOWER THAN -0.5mV / V.
- THE LOAD CELLS INPUT SIGNAL IS HIGHER THAN +3.5mV / V.
- THE LOAD CELLS INPUT SIGNAL IS MISSING.

DISPLAY WEIGHT VALUE.

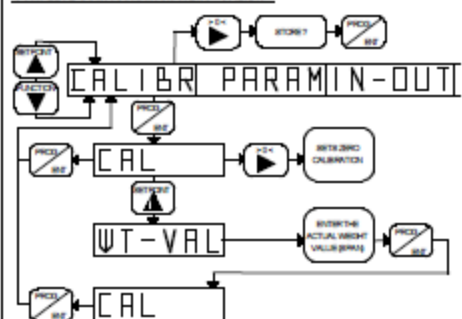


For the overload, the formula is:
 $(\text{hook's weight} \times 10\%) + \text{hook's weight}$
 $(36000 \times 10\%) + 36000 = 39600$

COMPLETE CONFIGURATION MENU "CONFIG"

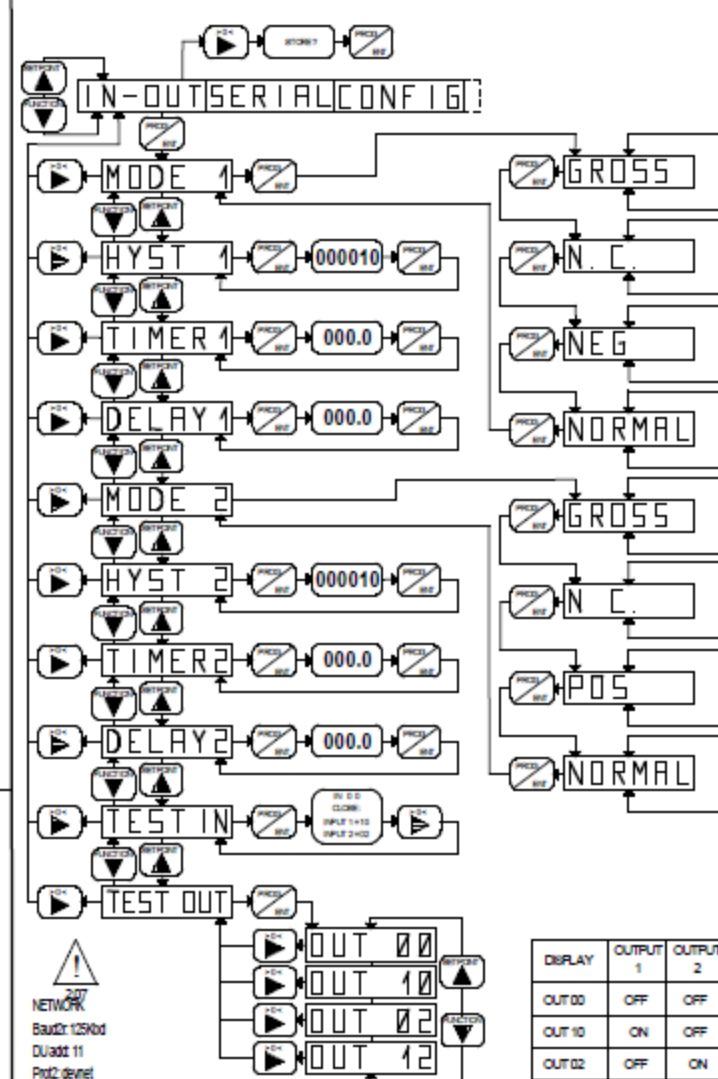


COMPLETE CONFIGURATION MENU "CALIBR"



NOTE: INPUT SIGNAL FROM THE TRANSDUCER MUST BE STABLE WHEN ENTERING THE ZERO AND SPAN VALUES.

COMPLETE CONFIGURATION MENU "IN - OUT"



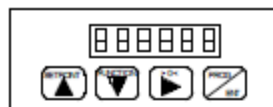
NETWORK
 Baudr: 125Kbd
 DU add: 11
 Prot2: denvet

DISPLAY	OUTPUT 1	OUTPUT 2
OUT 00	OFF	OFF
OUT 10	ON	OFF
OUT 02	OFF	ON
OUT 12	ON	ON





MANUAL SETUP

Setting for TP1-WT-02 / AE02 module (overload)

DESCRIPTION OF THE FRONT PANEL OF THE VISHAY TRANSDUCER.

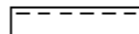


COMPLETE CONFIGURATION MENU OF THE VISHAY TRANSDUCER.

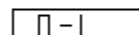
PLACE THE UNIT IN COMPLETE CONFIGURATION MODE BY PRESSING AND HOLDING THE  AND  KEYS. THE  KEY MUST BE PRESSED AFTER  KEY.

RELEASE THE  AND  KEYS WHEN **CONFIG** IS DISPLAYED.

ERROR MESSAGES.

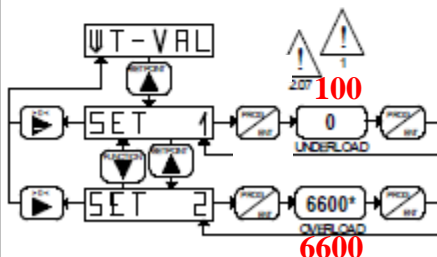


- THE WEIGHT DISPLAYED BY THE INSTRUMENT IS MORE THAN 9 DIVISIONS OVER THE "LIVE" WEIGHT VALUE.



- THE LOAD CELL'S INPUT SIGNAL IS LOWER THAN -0.5mV / V.
- THE LOAD CELL'S INPUT SIGNAL IS HIGHER THAN +3.5mV / V.
- THE LOAD CELL'S INPUT SIGNAL IS MISSING.

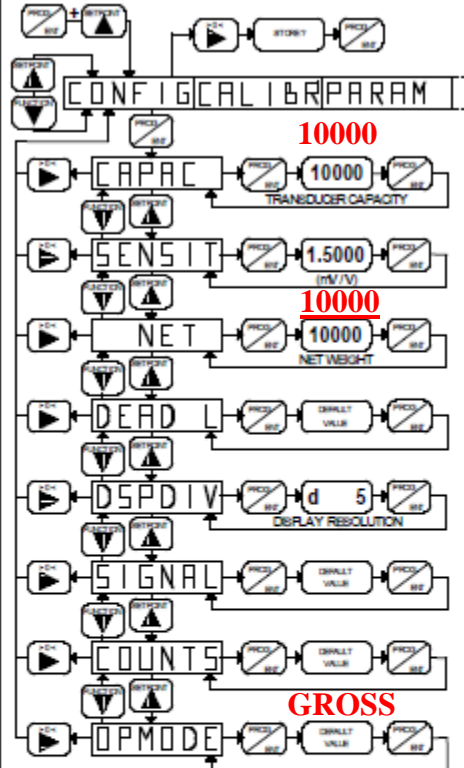
DISPLAY WEIGHT VALUE.



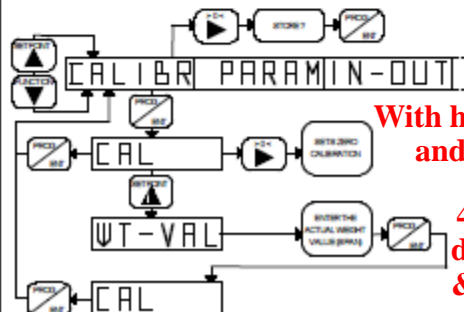
For the overload, the formula is:

* = Tapping overload / 6

COMPLETE CONFIGURATION MENU "CONFIG"

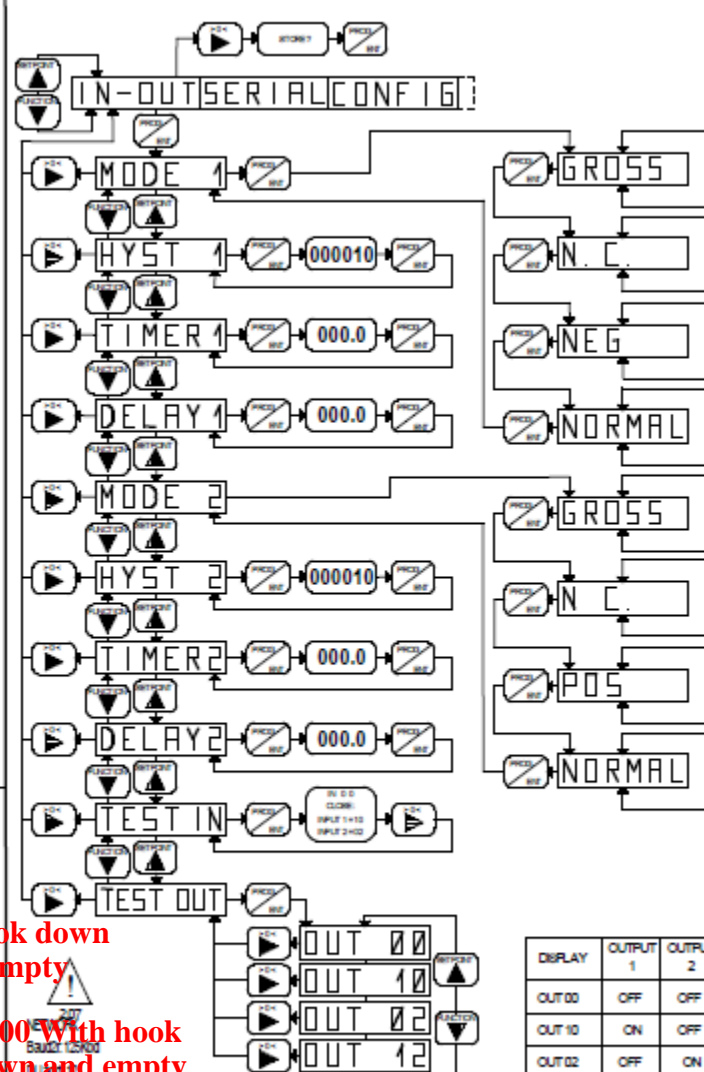


COMPLETE CONFIGURATION MENU "CALIB"

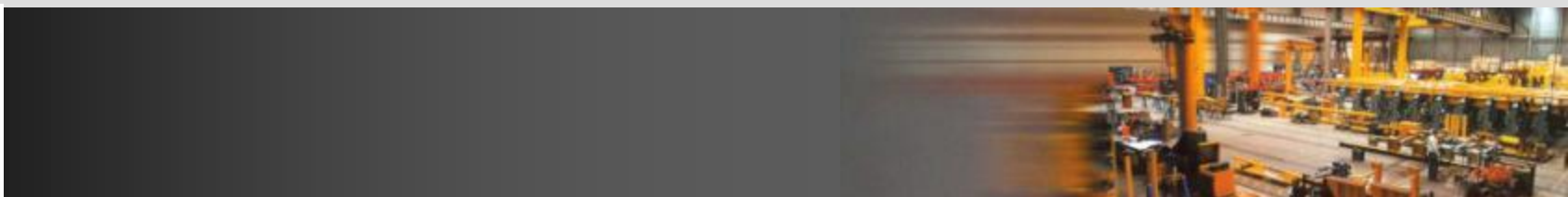


NOTE: INPUT SIGNAL FROM THE TRANSDUCER'S MUST BE STABLE WHEN ENTERING THE ZERO AND SPAN VALUES.

COMPLETE CONFIGURATION MENU "IN - OUT"



DISPLAY	OUTPUT 1	OUTPUT 2
OUT 00	OFF	OFF
OUT 10	ON	OFF
OUT 02	OFF	ON
OUT 12	ON	ON



EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

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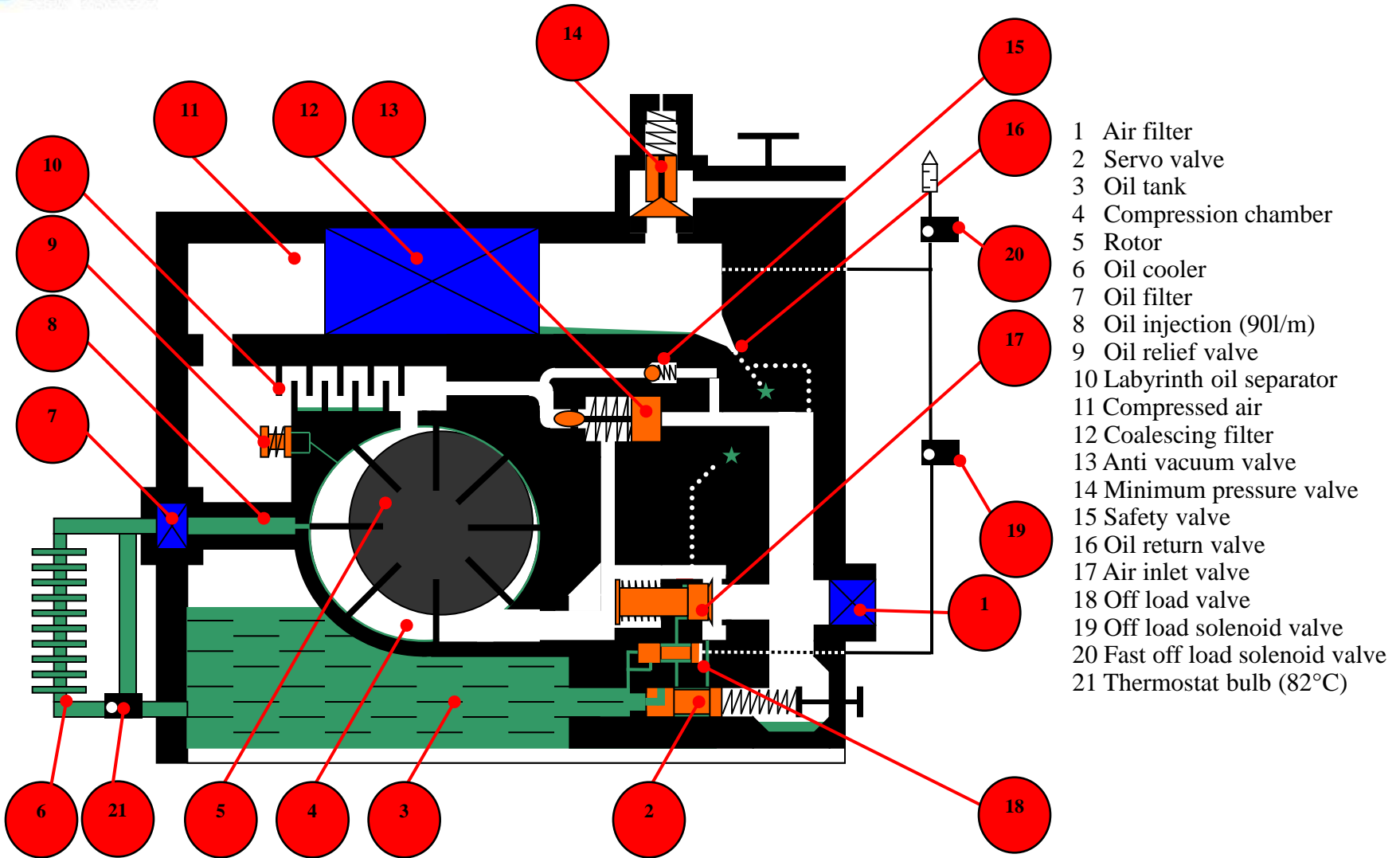
MA'ADEN PROJECT

P1034 - PTM

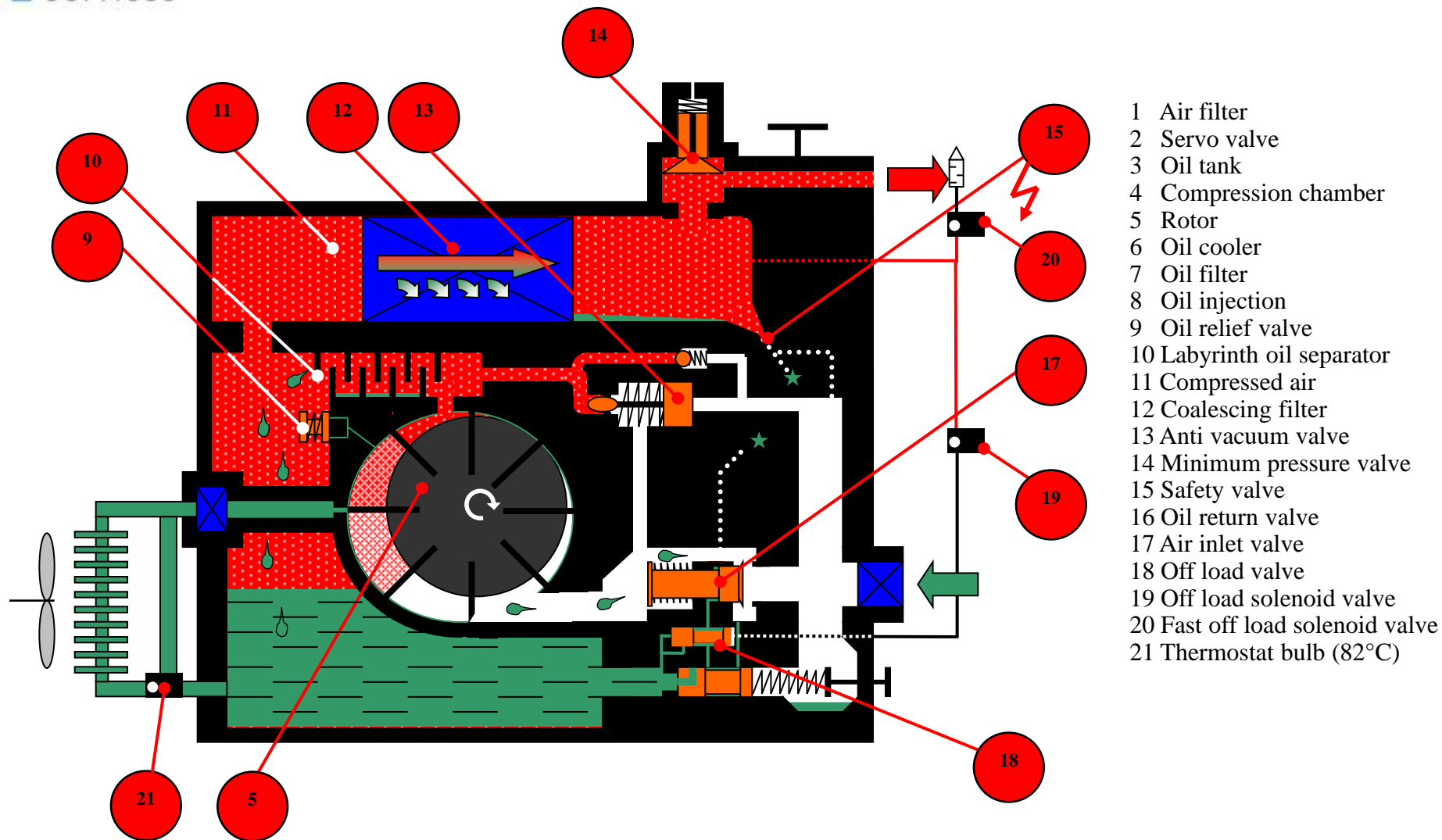
POT TENDING MACHINE

**Compressor MS 880 L ECL
Electrical**

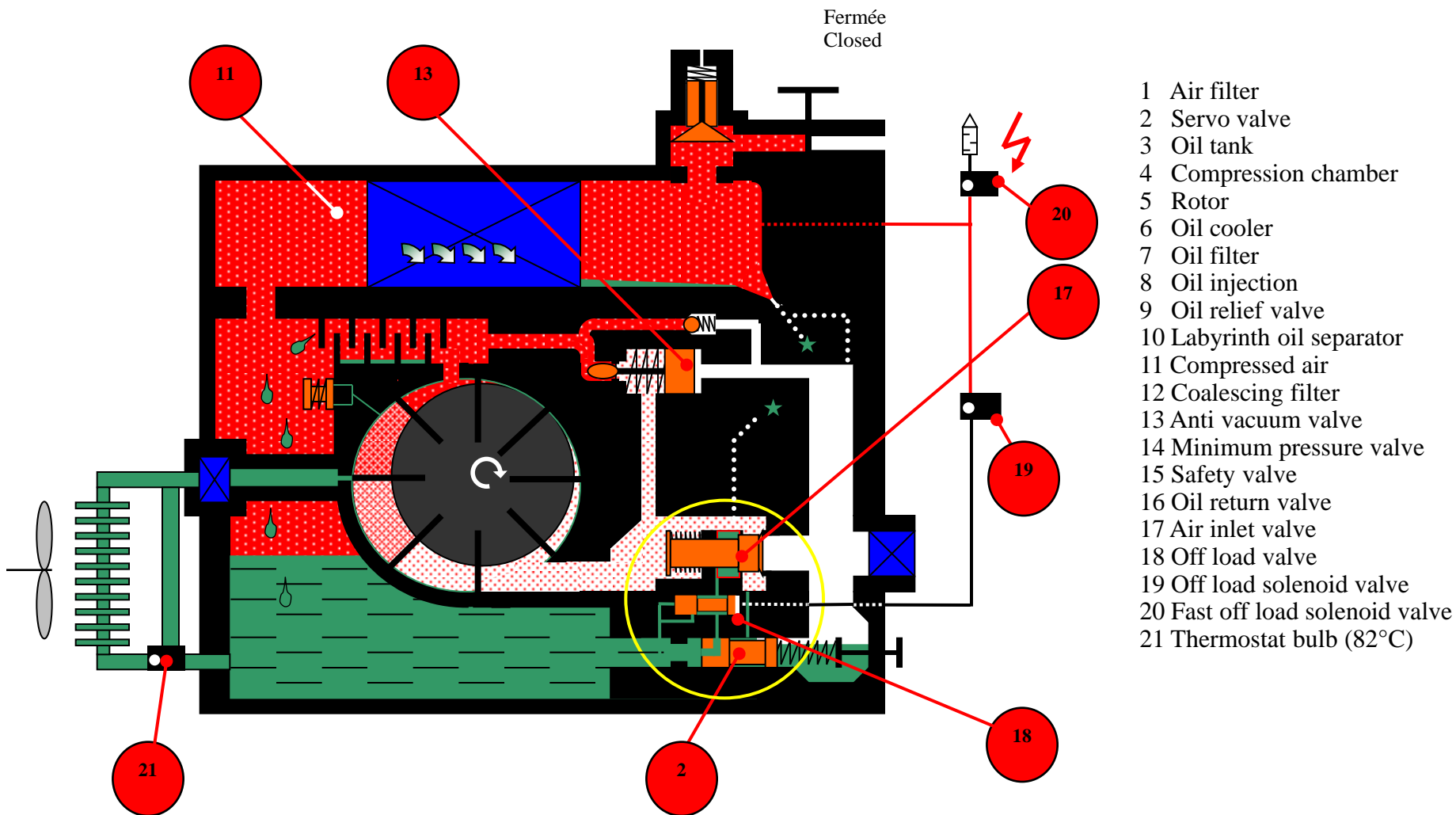
PRINCIPLE: GENERAL VIEW



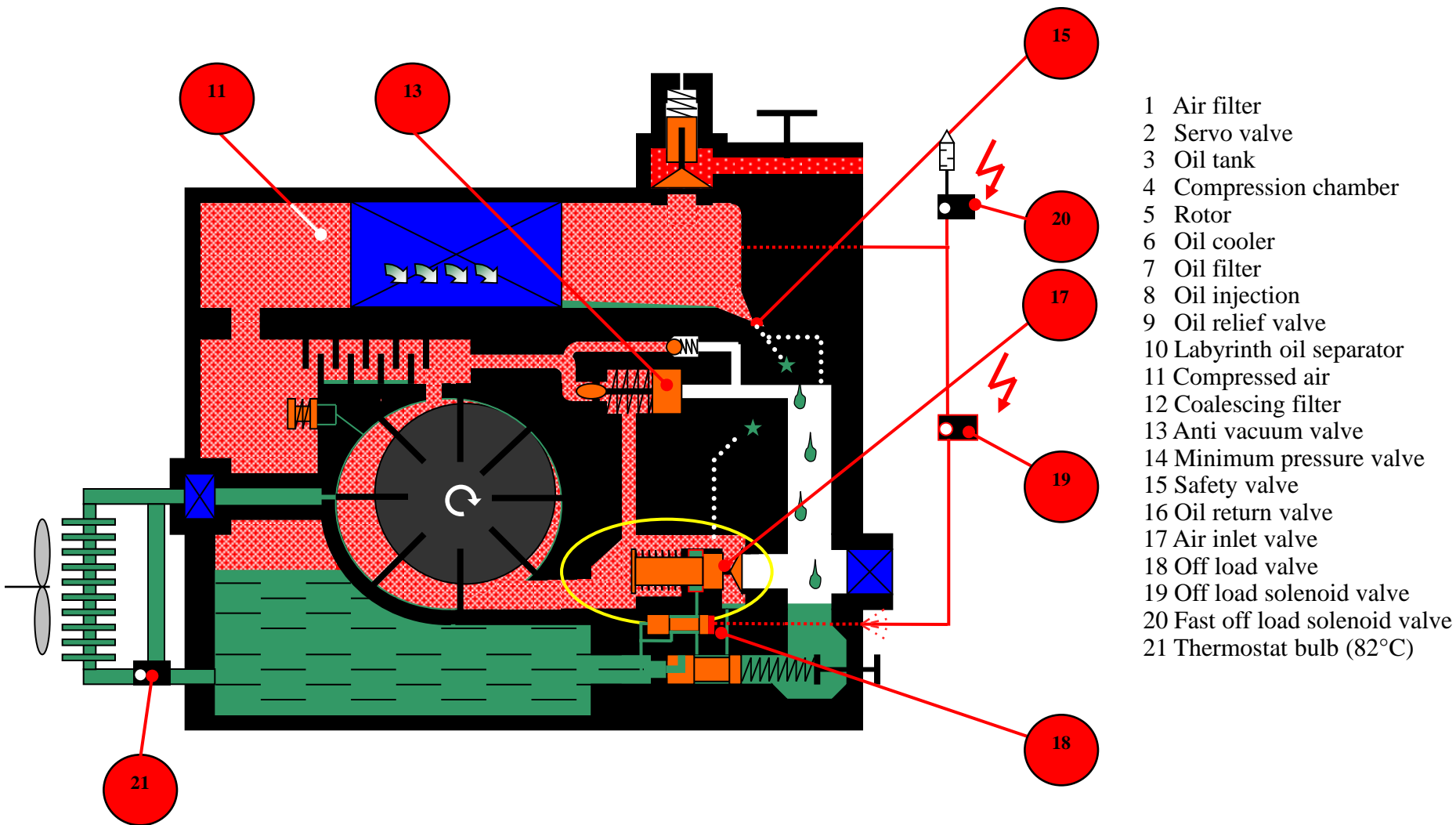
PRINCIPLE: FULL FLOW



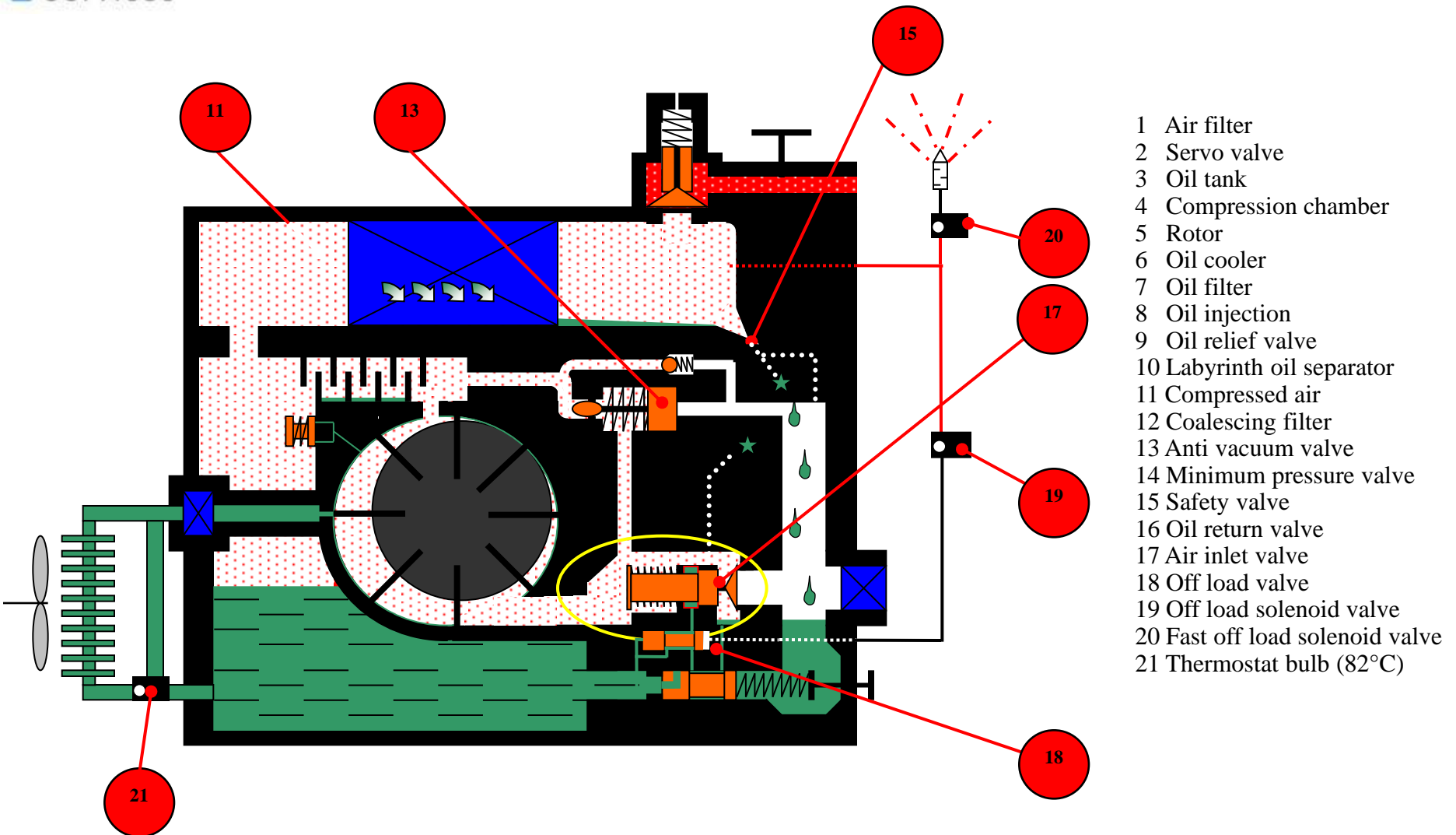
PRINCIPLE: NO FLOW



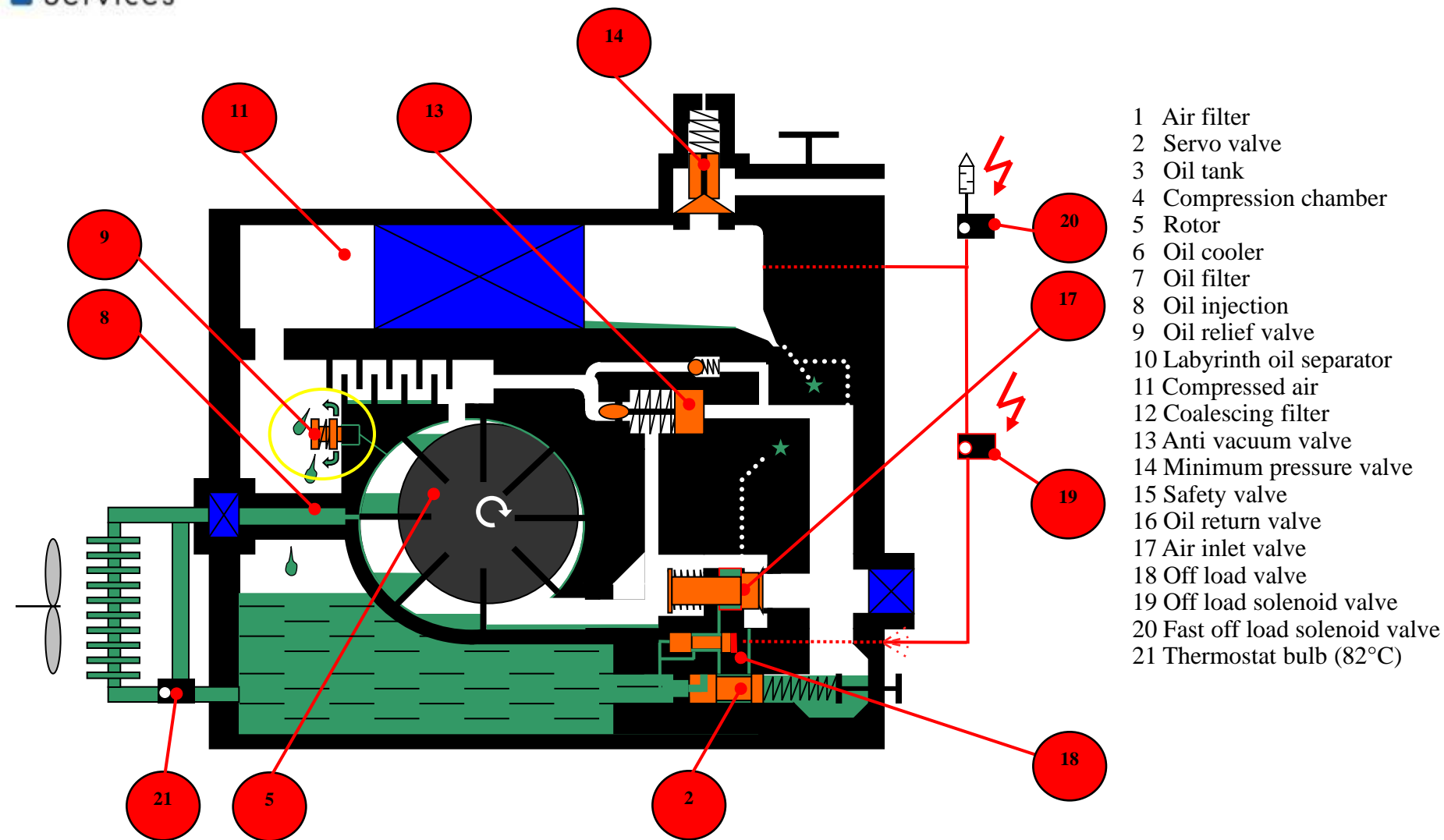
PRINCIPLE: STOPPING (60 sec)



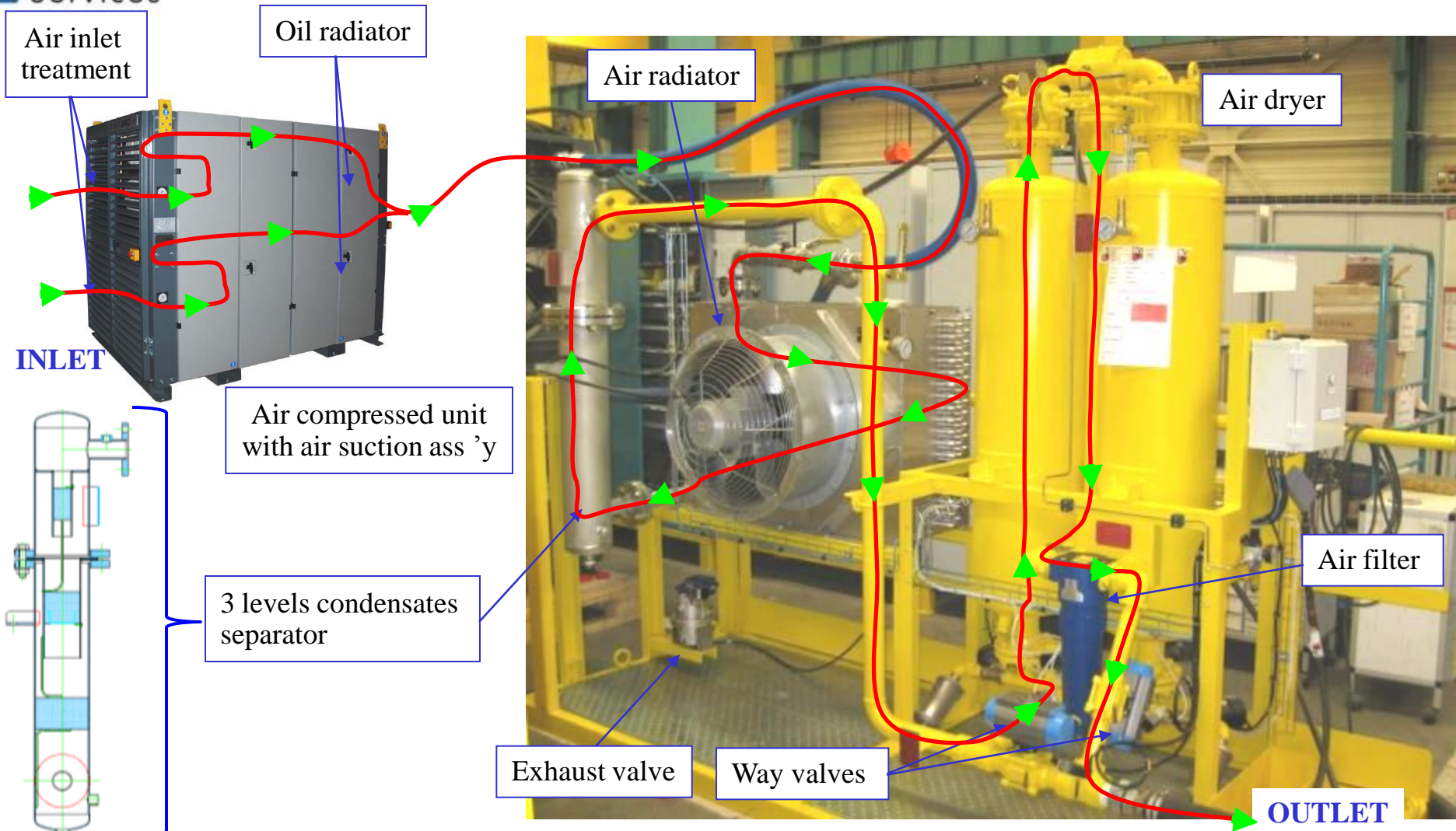
PRINCIPLE: JUST STOPPED (after 60 sec)



PRINCIPLE: STARTING

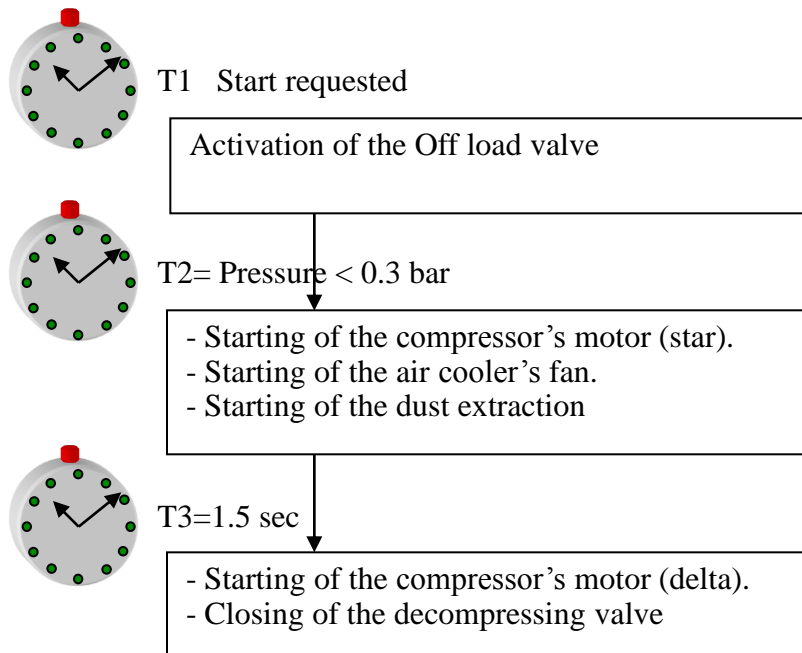


AIR COMPRESSOR UNIT (Type MS 880 L ECL – 14 700 l/mn – 7.5 bars)

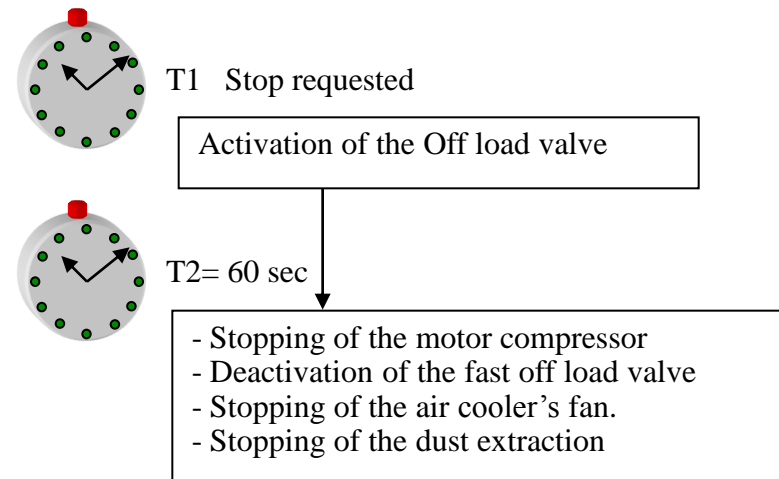


STARTING

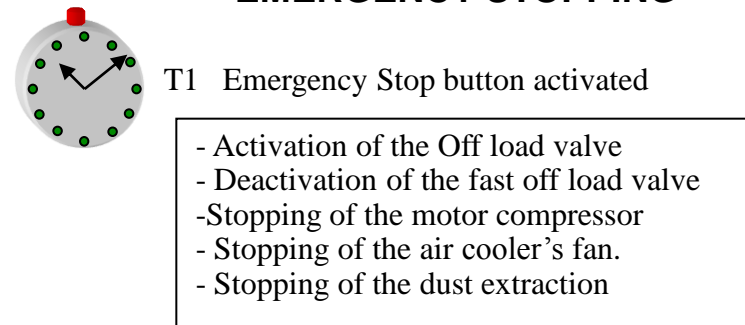
NORMAL STARTING



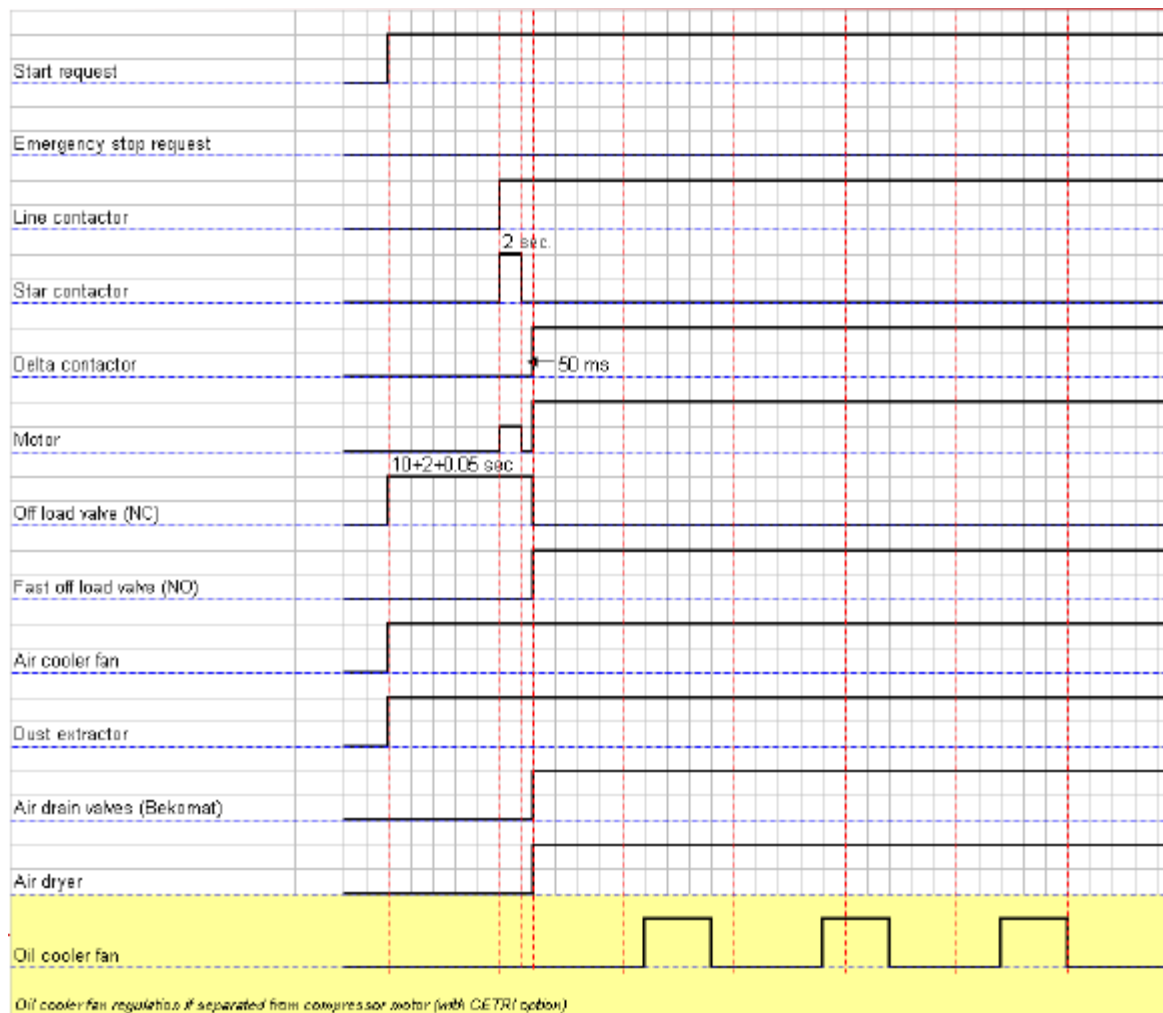
NORMAL STOPPING



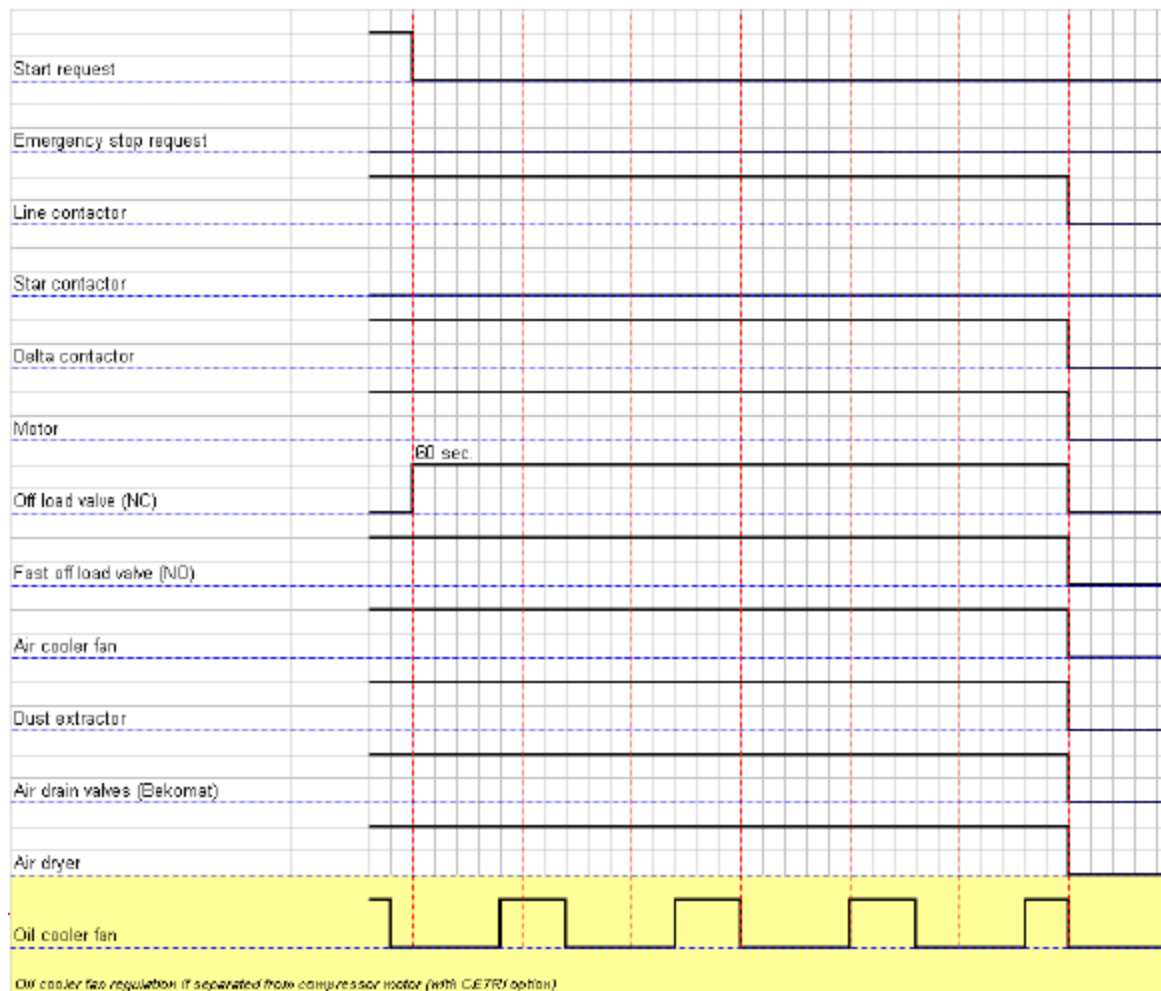
EMERGENCY STOPPING



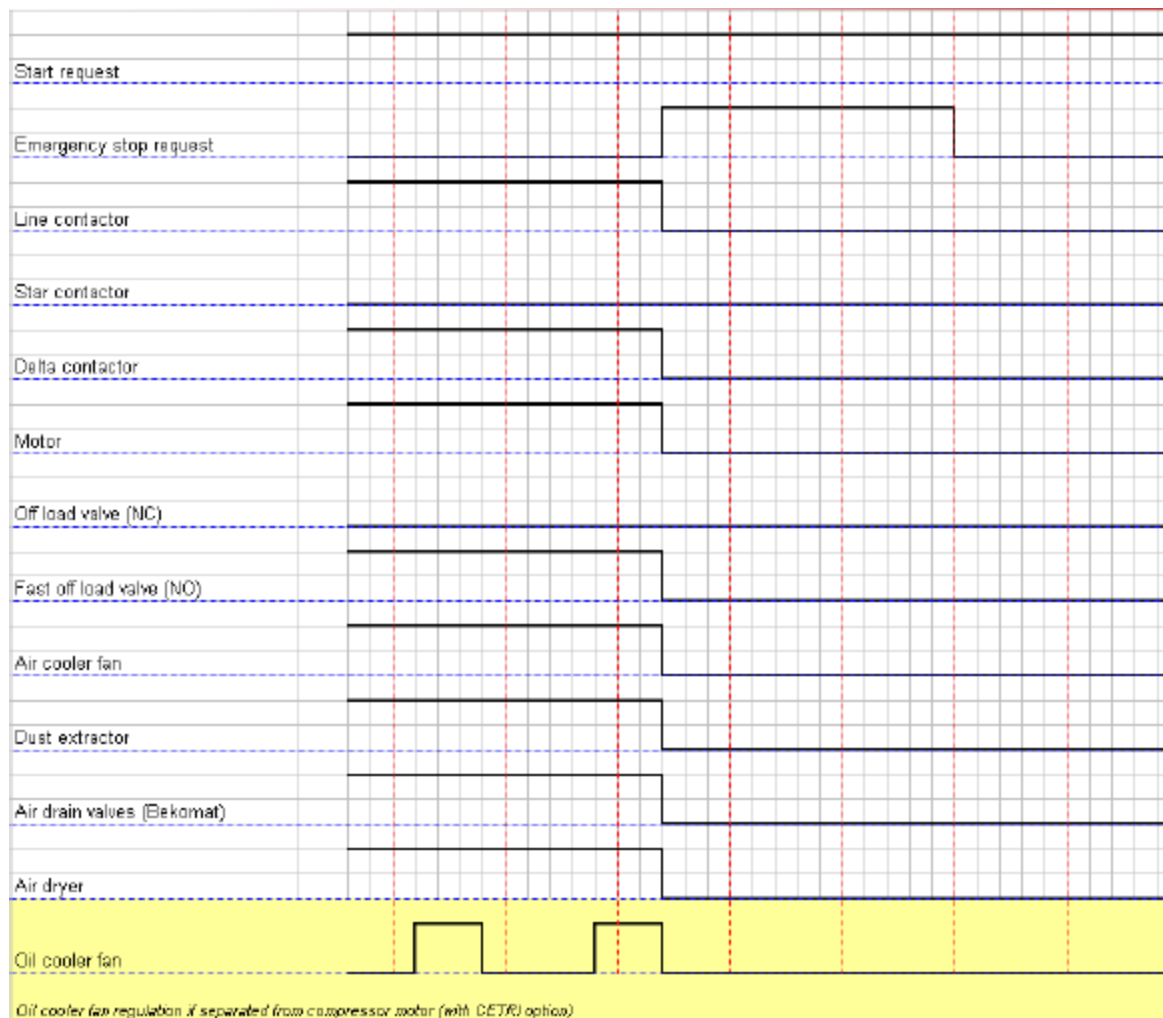
STARTING



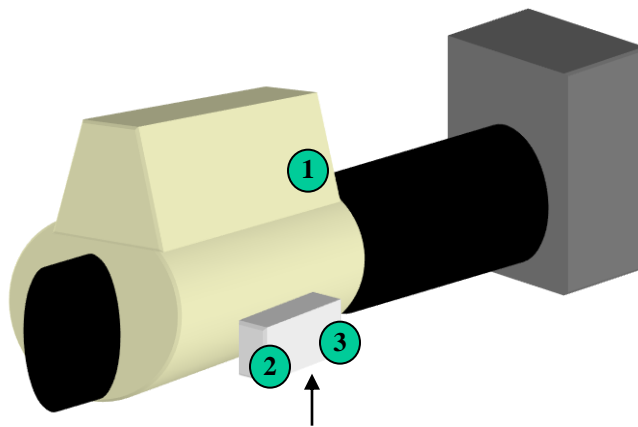
NORMAL STOPPING (during 60 sec)



EMERGENCY STOP STOPPING SEQUENCE



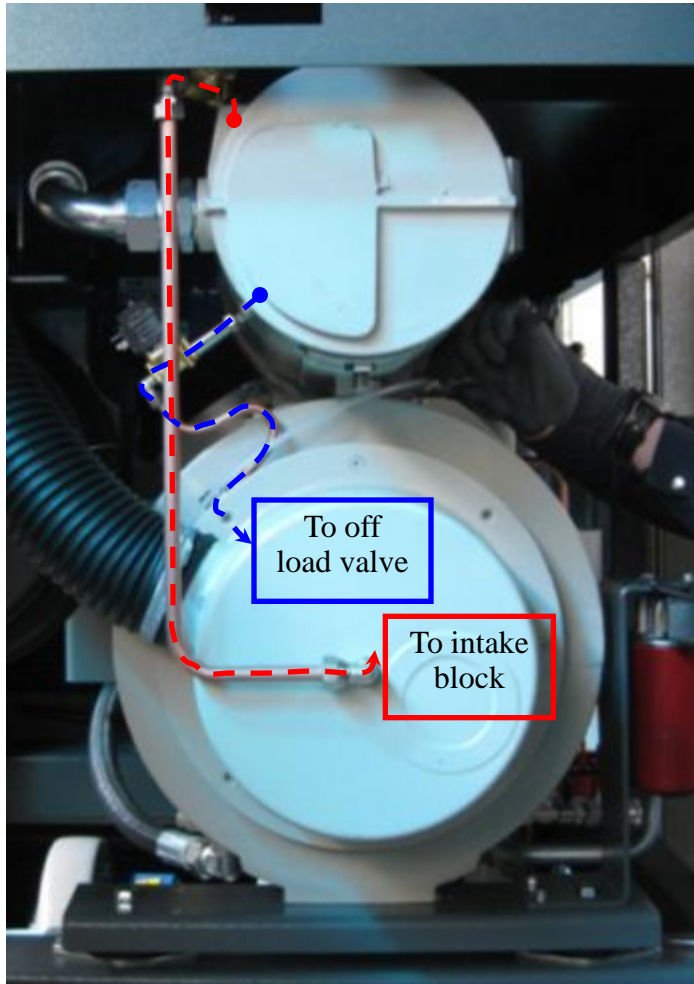
THERMIC CONTROL



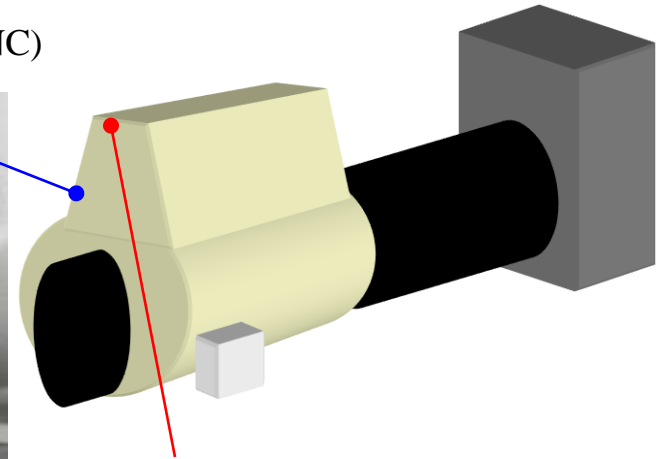
N°	Localisation / Localisation	Electrical Rep	T°C	Fonction / Function
1	Séparateur air huile / Air oil separator	A1.8 / A2.8	135	- Sonde sécurité / Security sensor - Arrête le compresseur / Stop the compressor
2	Carter d'huile/ Oil Compressor housing	A1.7 / A2.7	115<x <5	- Arrête le compresseur / Stop the compressor
3	Carter d'huile (vertic.)/ Oil housing (vertic.)	A1.7 / A2.7	105	- Alerte haute T°C huile / High oil T°C - Alerte reportée en cabine / Message reported in the cabin



OFF LOAD VALVE



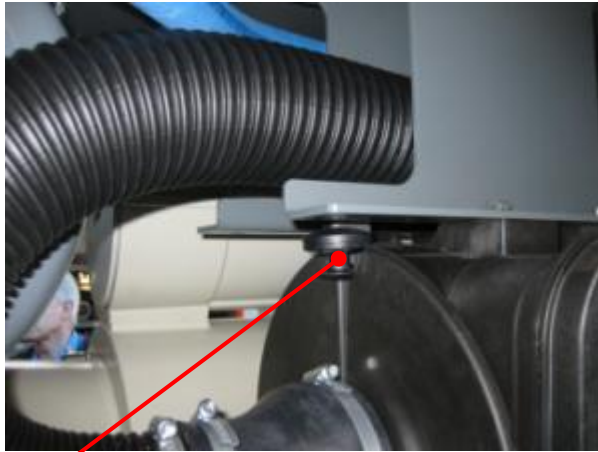
Off load solenoid valve (NC)



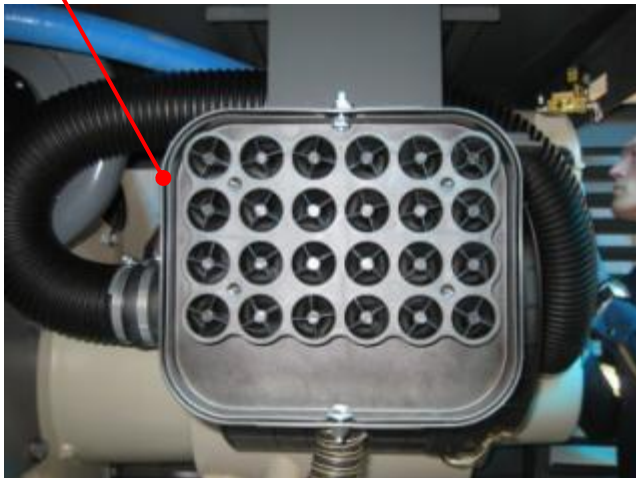
Fast off load solenoid valve (NO)



FILTER & AIR PRESSURE CONTROL

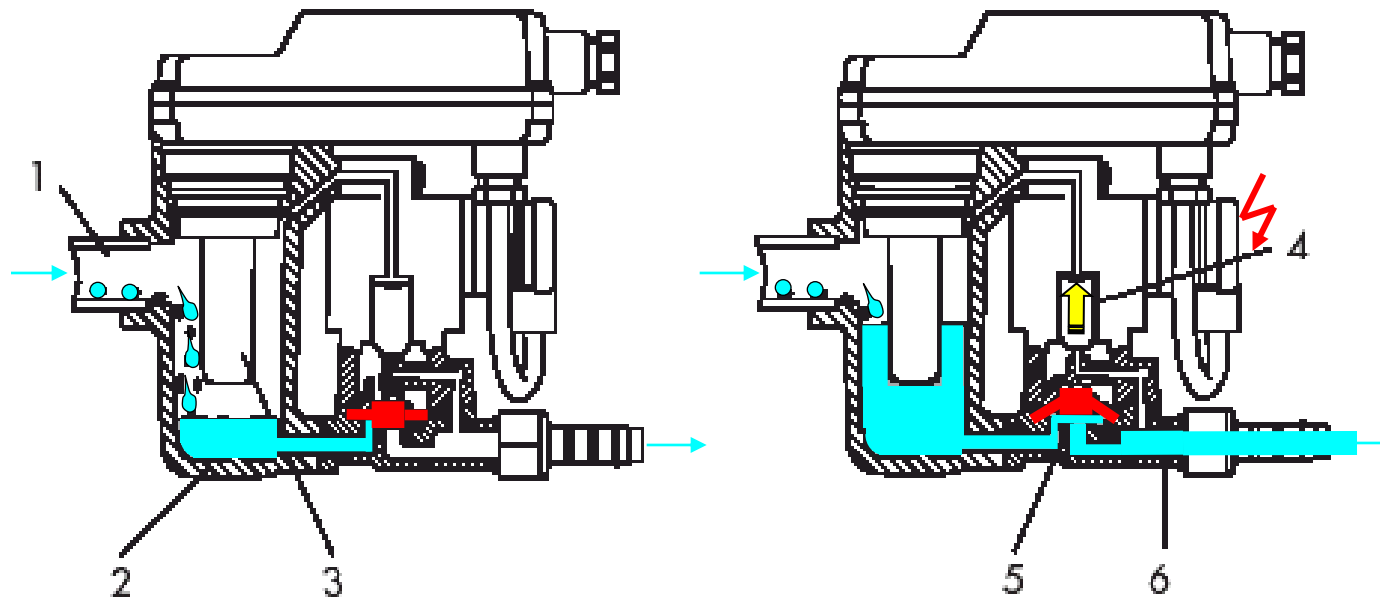


Inlet filter clogged sensor



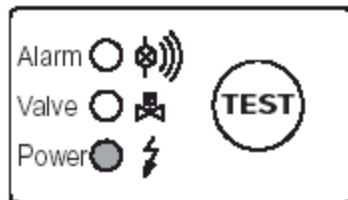
Air pressure detection (5.5 bar)

CAPACITY DRAIN VALVE BEKOMAT

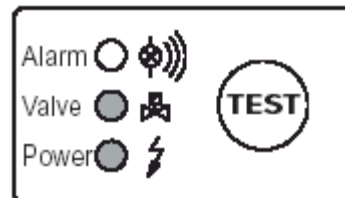


- 1 Inlet line
- 2 Tank
- 3 Capacity sensor
- 4 Pilot valve
- 5 Diaphragm
- 6 Outlet line

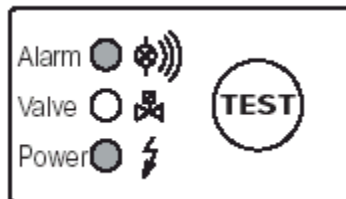
CAPACITY DRAIN VALVE BEKOMAT



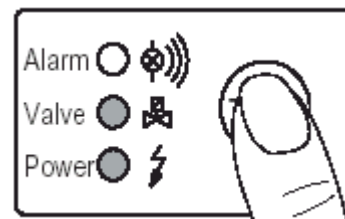
Ready for opération



Evacuation to outlet line



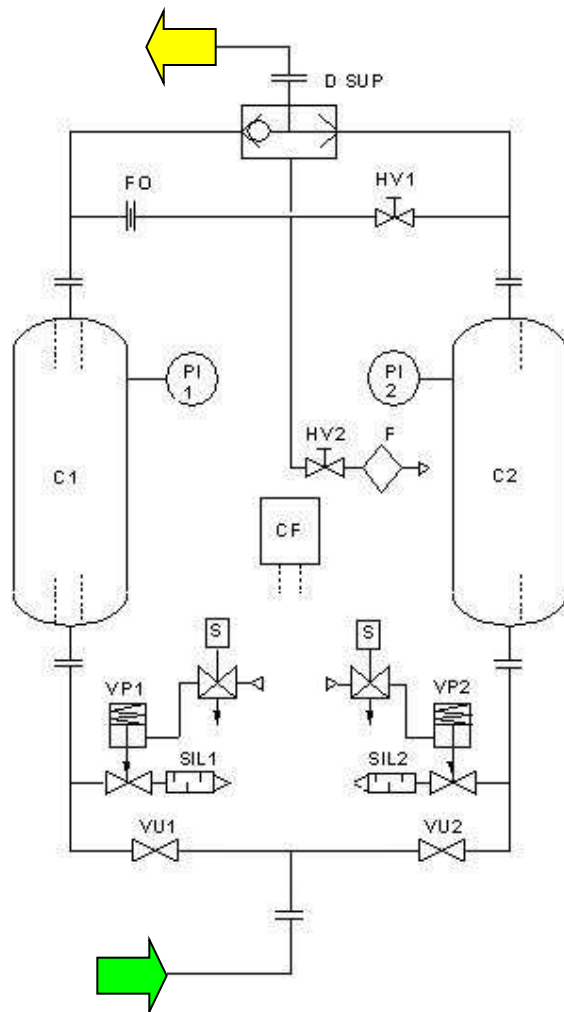
Alarm. Valve in fault



Manuel evacuation order



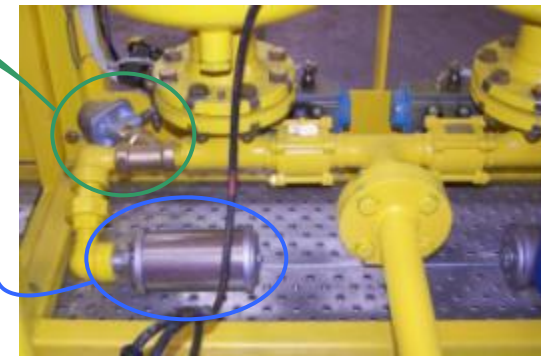
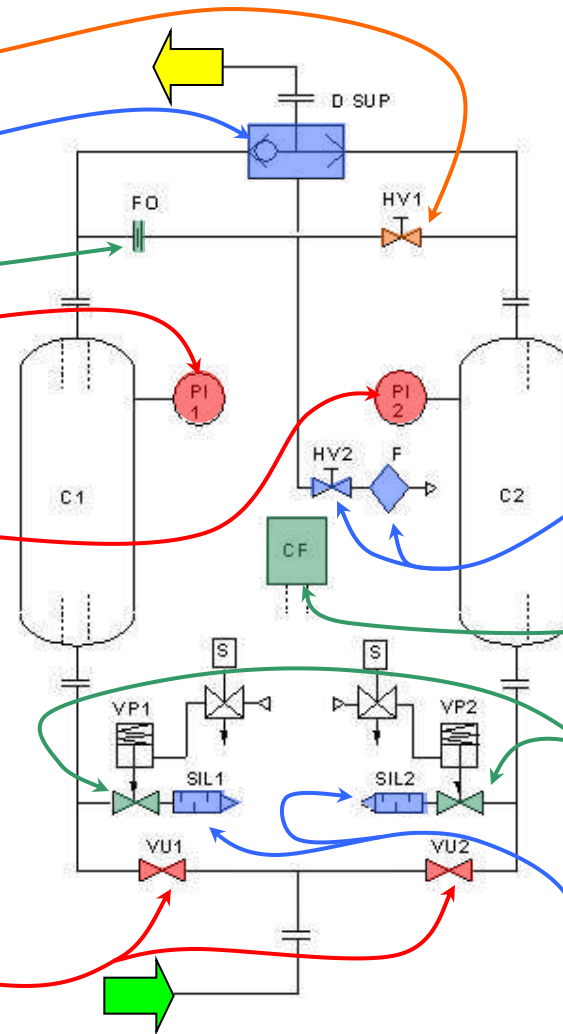
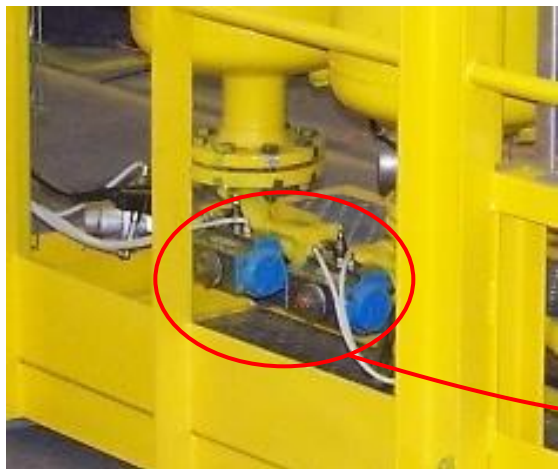
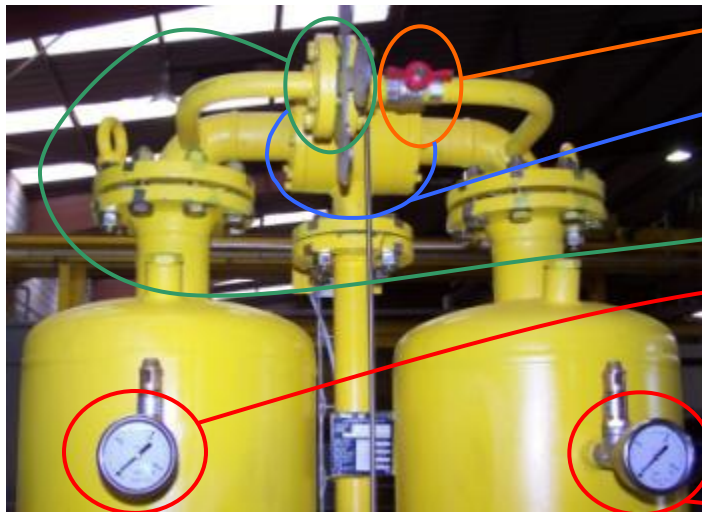
AIR DRYER



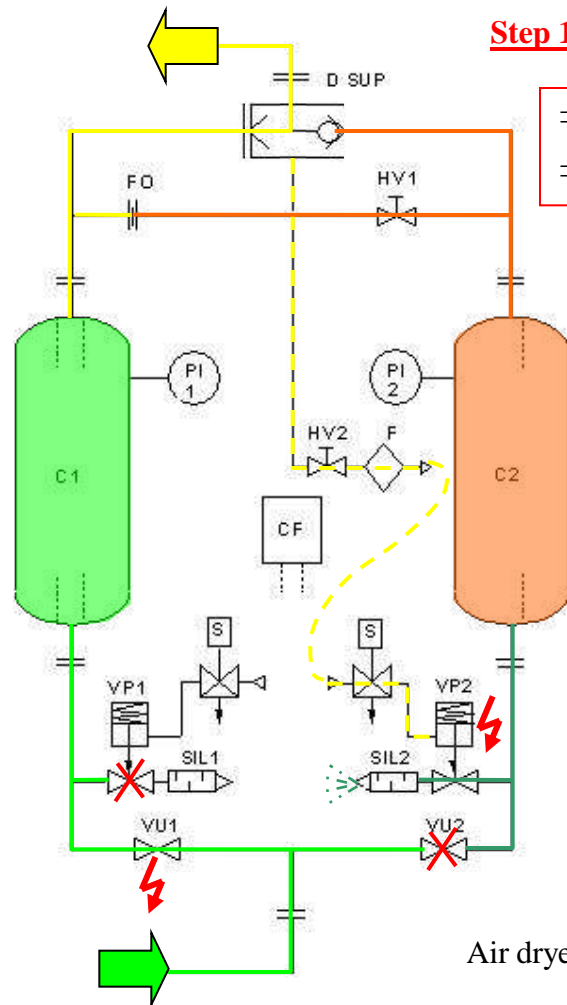
- C1 Drying column
- C2 Drying column
- D SUP Change over valve
- HV1 Manual valve
- FO Calibrate hole
- VU1 Distributor valve
- VU2 Distributor valve
- PI1 Pressure gauge
- PI2 Pressure gauge
- VP1 Drain pneu valve
- VP2 Drain pneu valve
- HV2 Pilot air valve
- F Air filter
- SIL1 Exhaust silencer
- SIL2 Exhaust silencer
- CF Electric box
- S Control valve



AIR DRYER



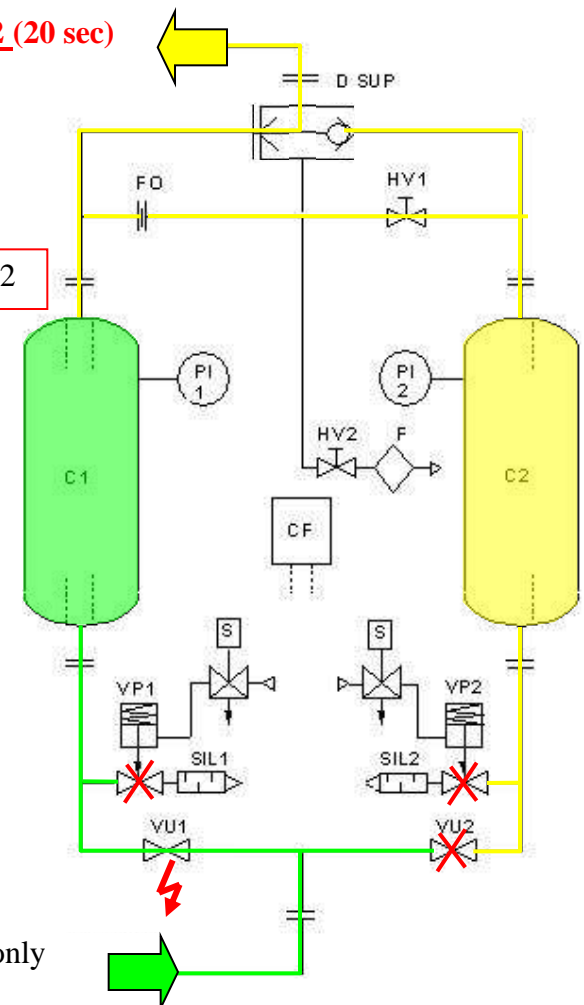
AIR DRYER



Step 1 (40 sec)

⇒ Drying by C1
⇒ Cleaning of C2

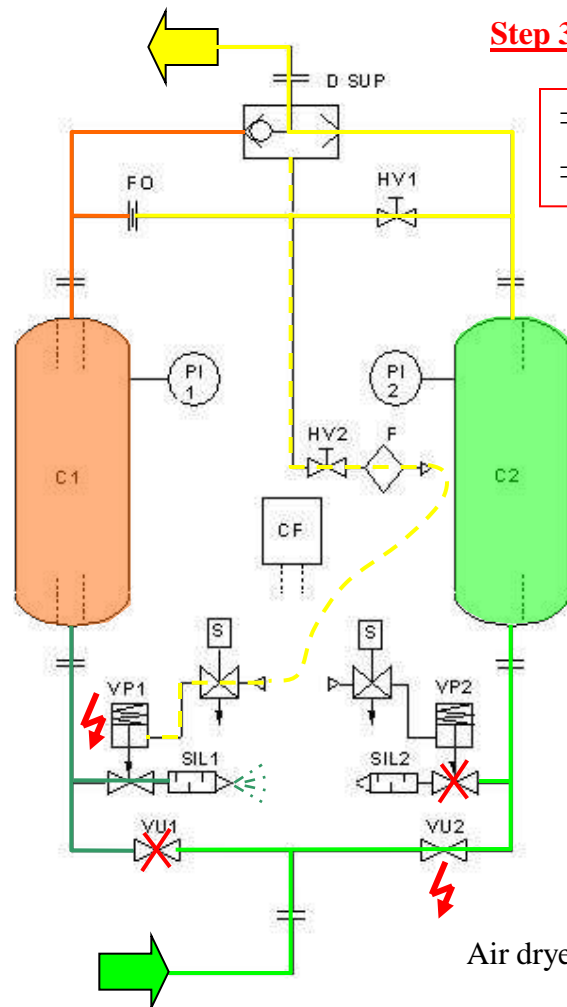
⇒ Pressurization of C2



Step 2 (20 sec)

Air dryer by-pass during metal tapping operation only

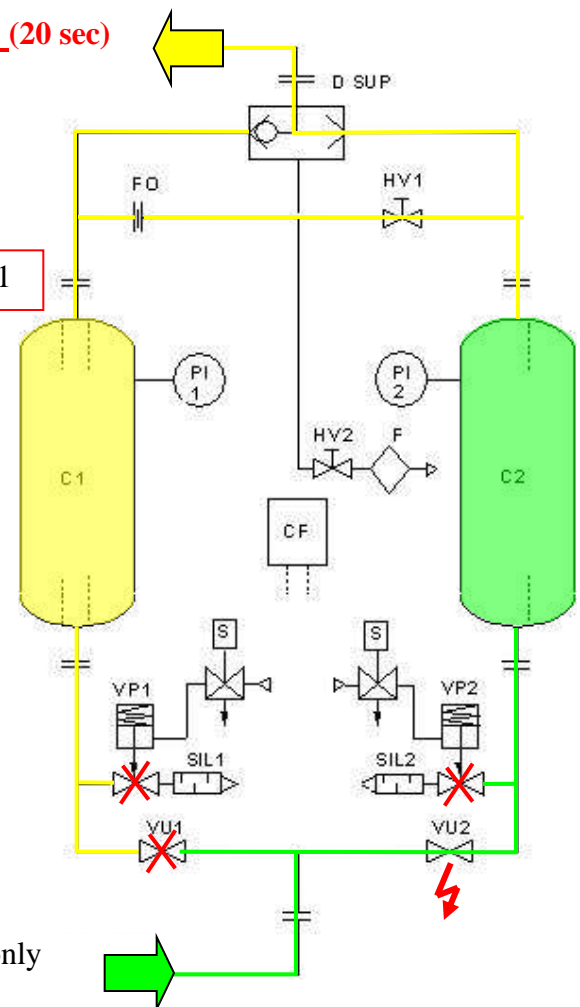
AIR DRYER



Step 3 (40 sec)

⇒ Drying by C2
⇒ Cleaning of C1

⇒ Pressurization of C1



Step 4 (20 sec)

Air dryer by-pass during metal tapping operation only



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MA'ADEN PROJECT

P1034 - PTM

POT TENDING MACHINE

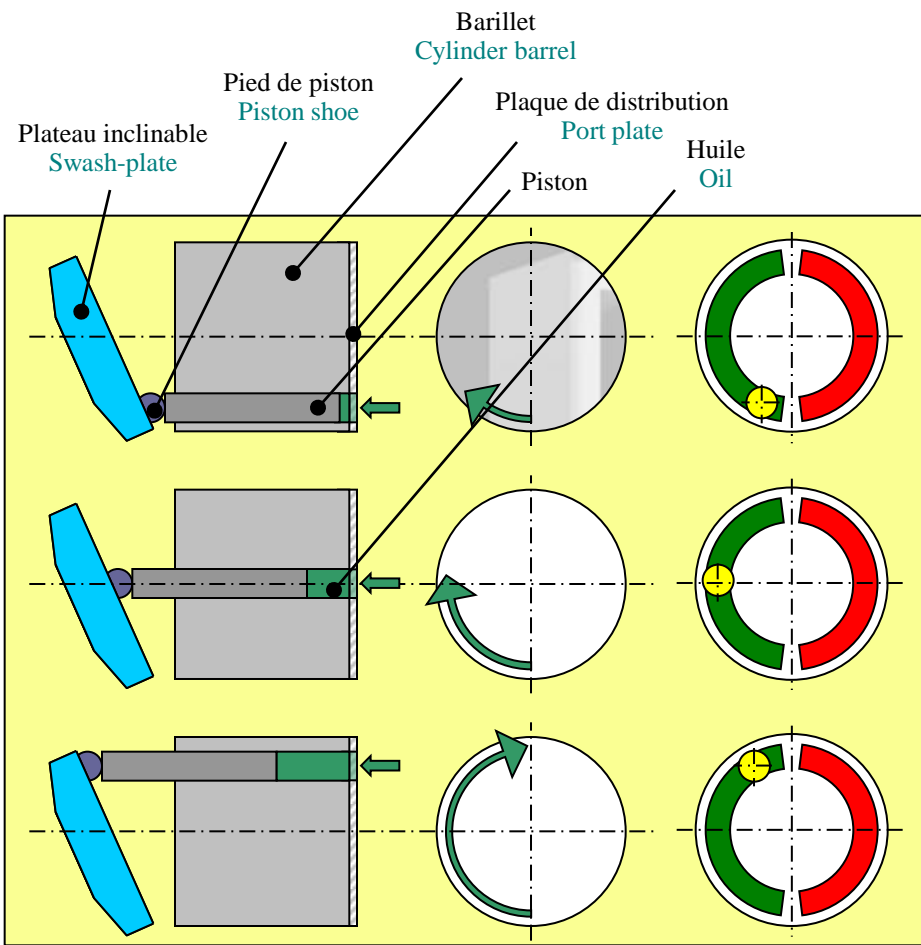
Hydraulic electrical adjustment

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

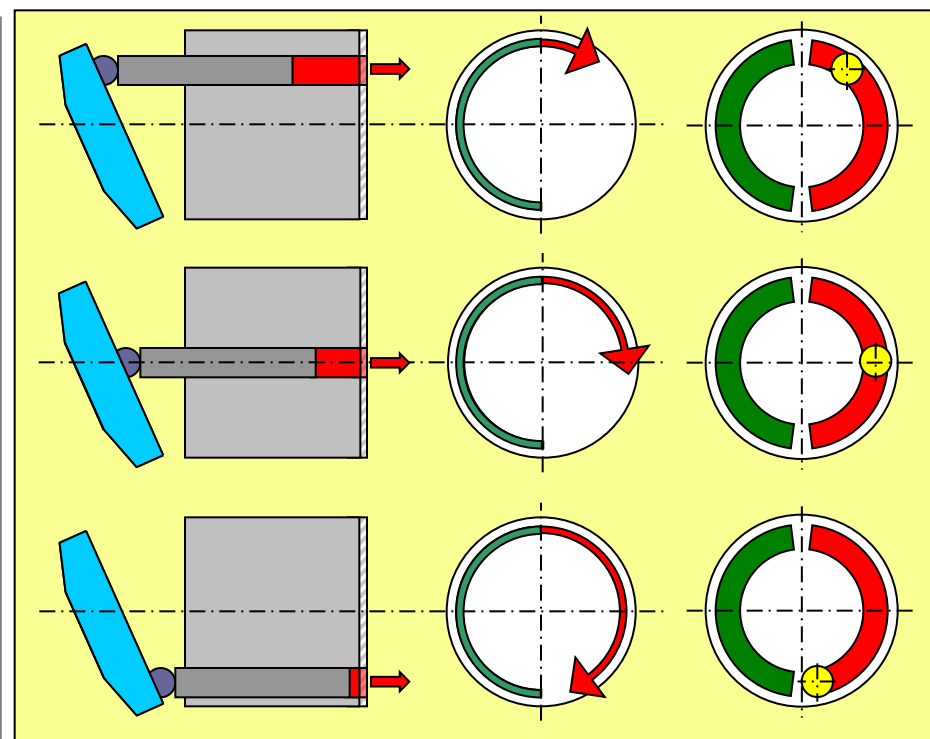
POMPES **PUMPS**

POMPES A PISTONS AXIAUX

AXIAL PISTON PUMP

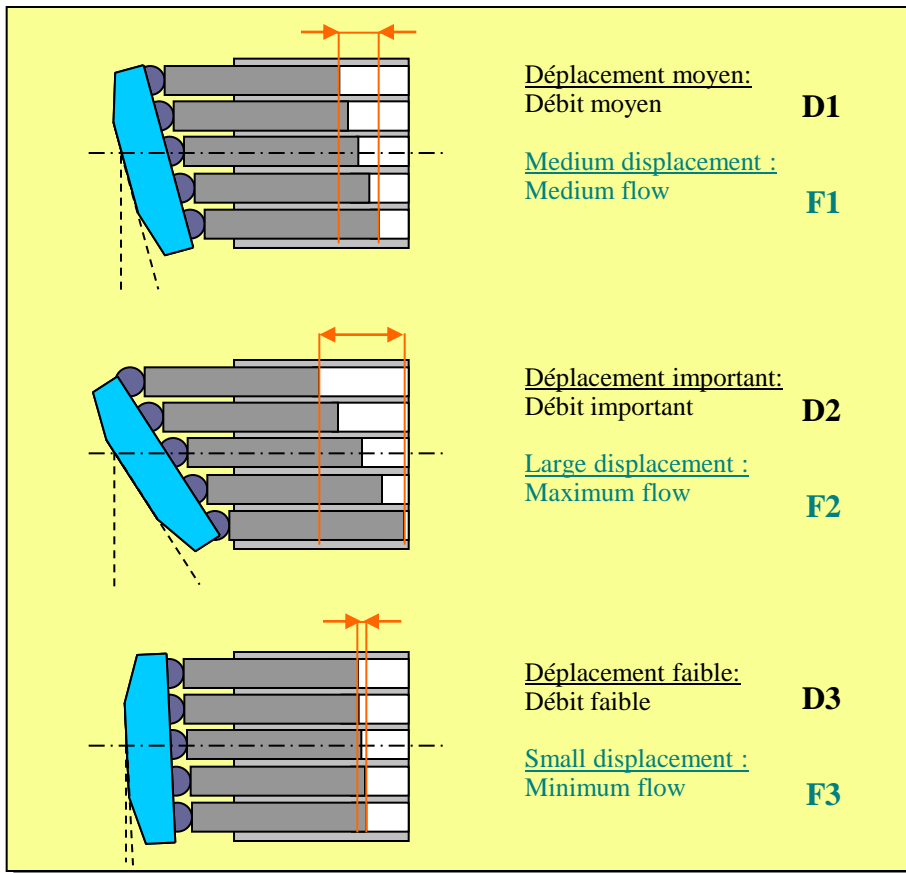


ASPIRATION / SUCTION



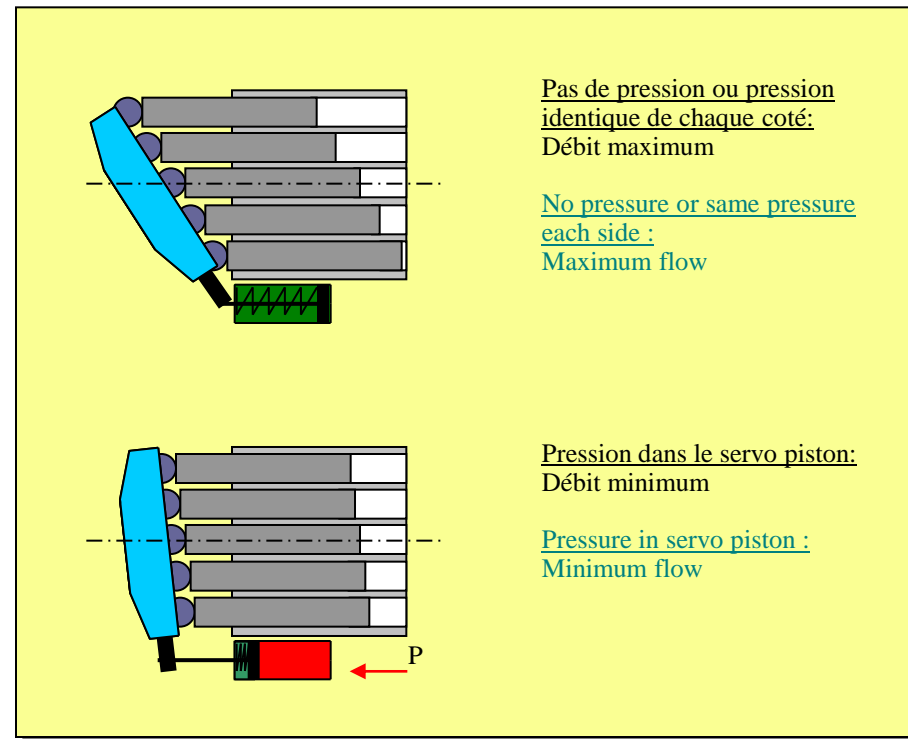
REFOULEMENT / OUTLET

DEBIT VARIABLE VARIABLE FLOW



REFOULEMENT/OUTLET

$D3 < D1 < D2$
 $F3 < F1 < F2$



SERVO PISTON

$P \rightarrow D1$
 $P \rightarrow F1$

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

DEBIT VARIABLE VARIABLE FLOW

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

VUES SIMPLIFIEES SIMPLIFIED SKETCHES

I. Avec servo piston With servo piston

- ▣ Arrêt
Stop
- ▣ Marche à vide
Stand by
- ▣ Régulation
Flow regulation
- ▣ Butée
Bump

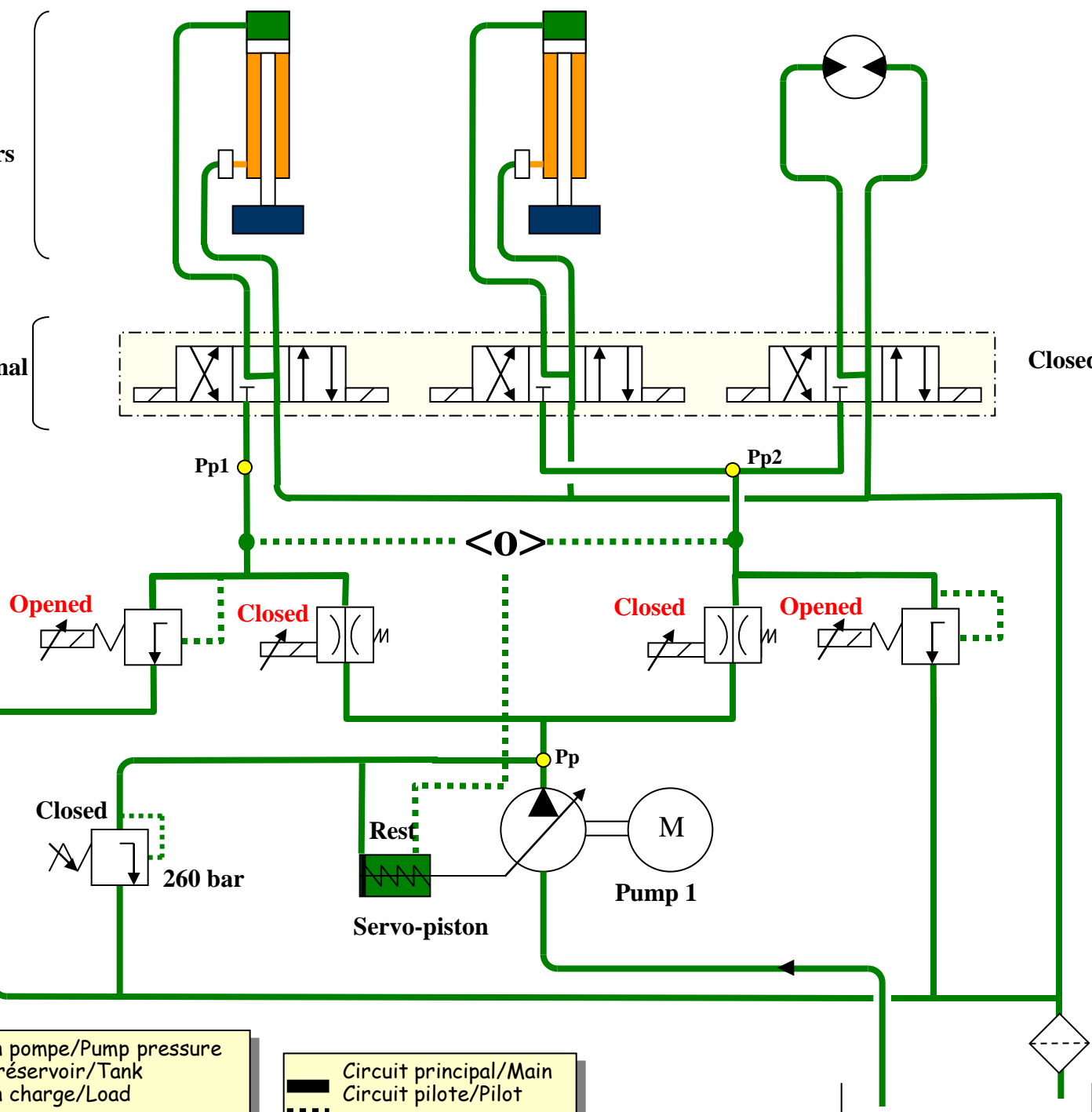
Arrêt
Stop

Actuators

Directional
valves

Closed

Hydraulic
Unit



Marche à vide
Stand by

Actuators

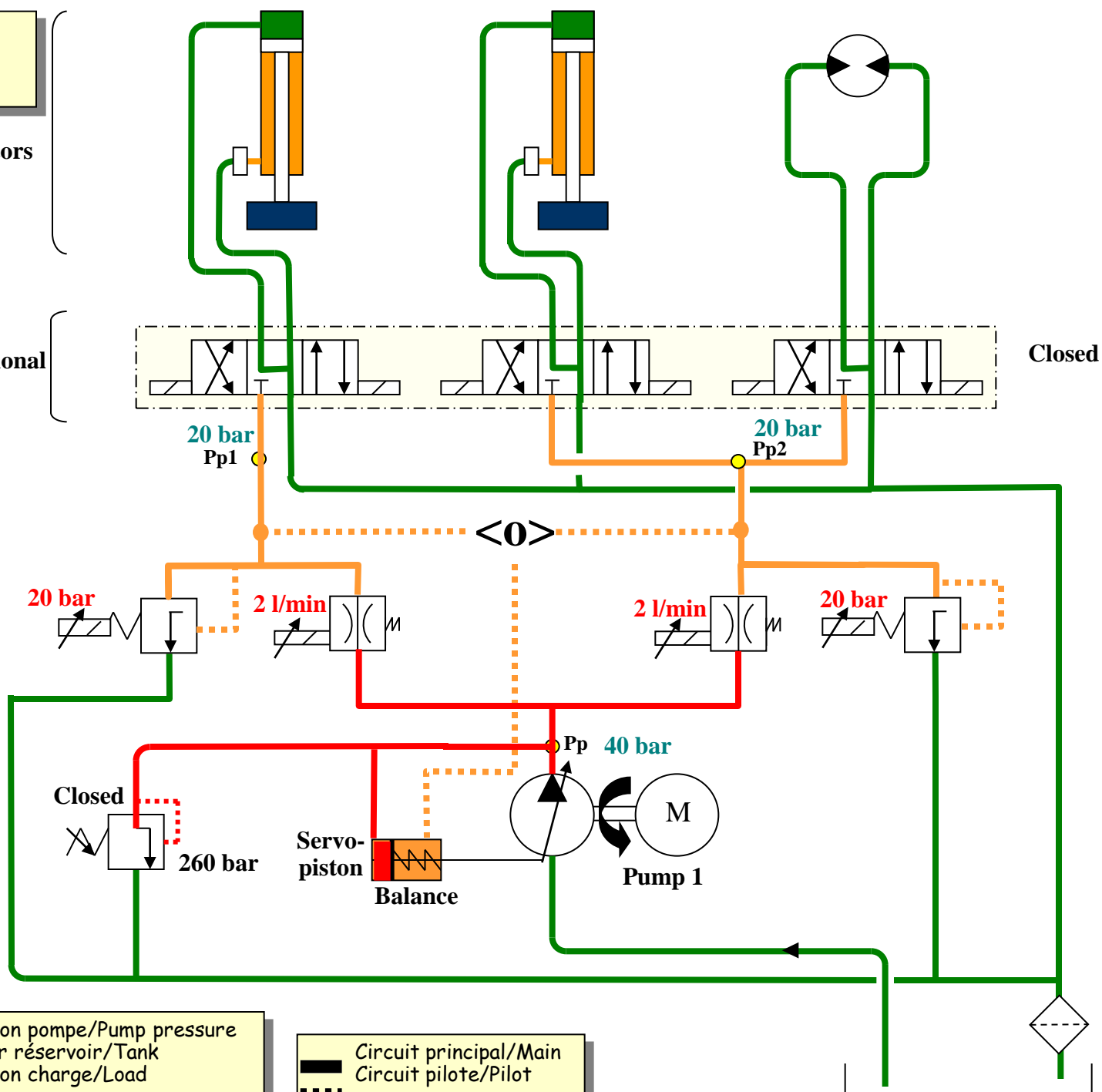
Directional
valves

Closed

Hydraulic
Unit

■ Pression pompe/Pump pressure
■ Retour réservoir/Tank
■ Pression charge/Load

■ Circuit principal/Main
... Circuit pilote/Pilot

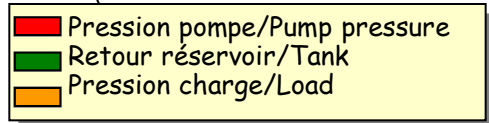




Régulation de débit
Flow regulation

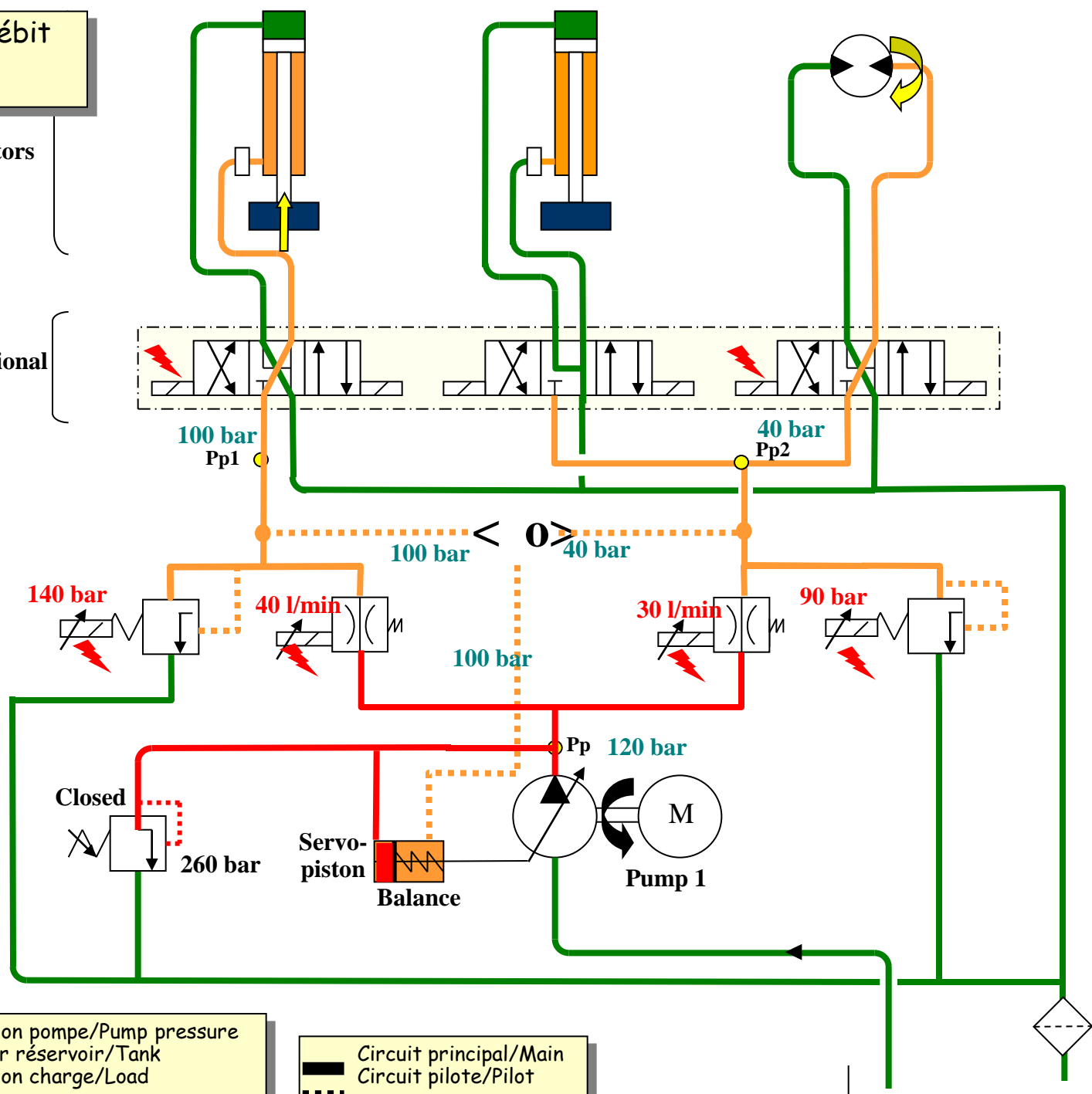
Actuators

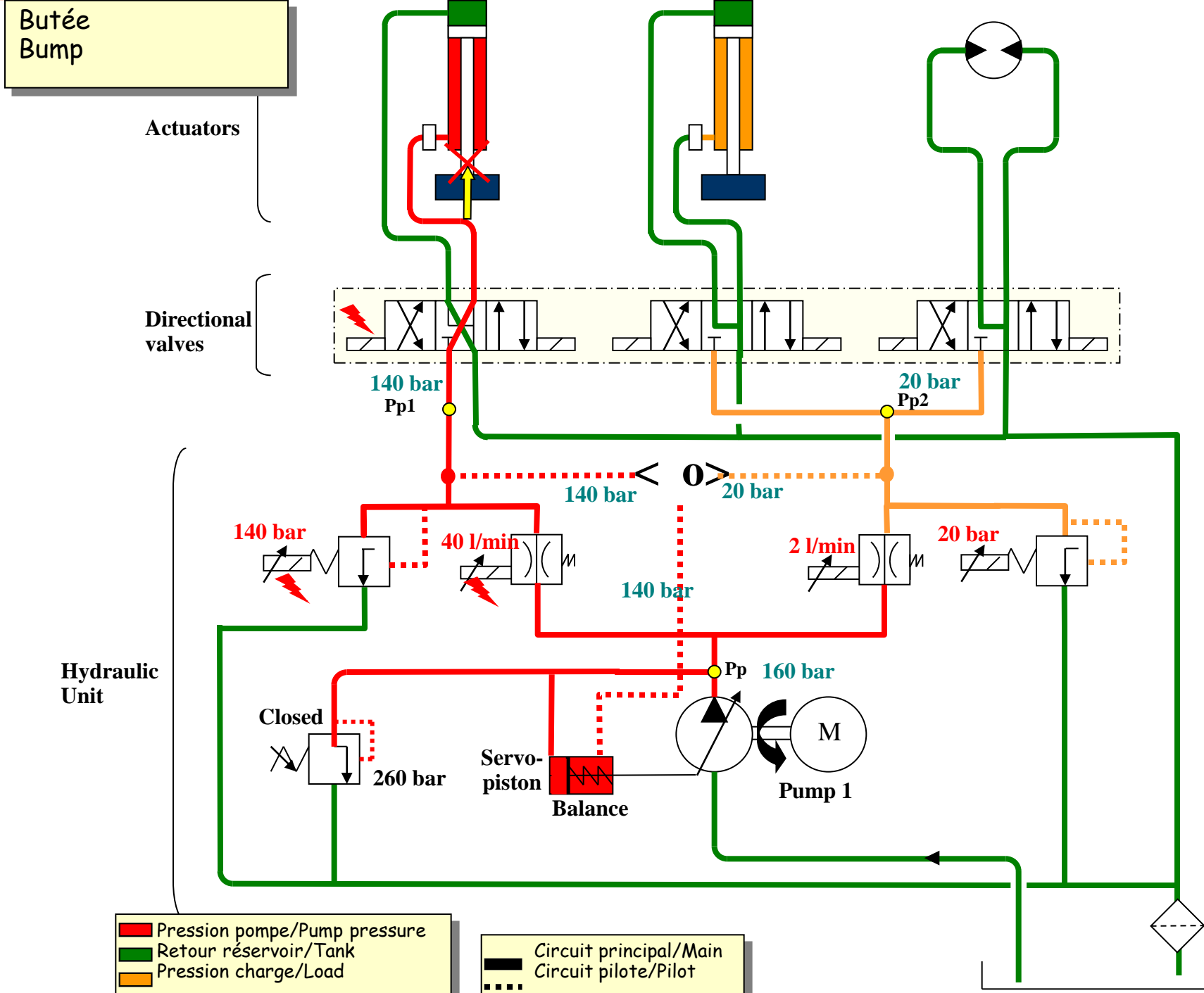
Directional valves

Hydraulic Unit



 	Circuit principal/Main Circuit pilote/Pilot
--	--







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EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

VUES COMPLETTES
COMPLETE SKETCHES

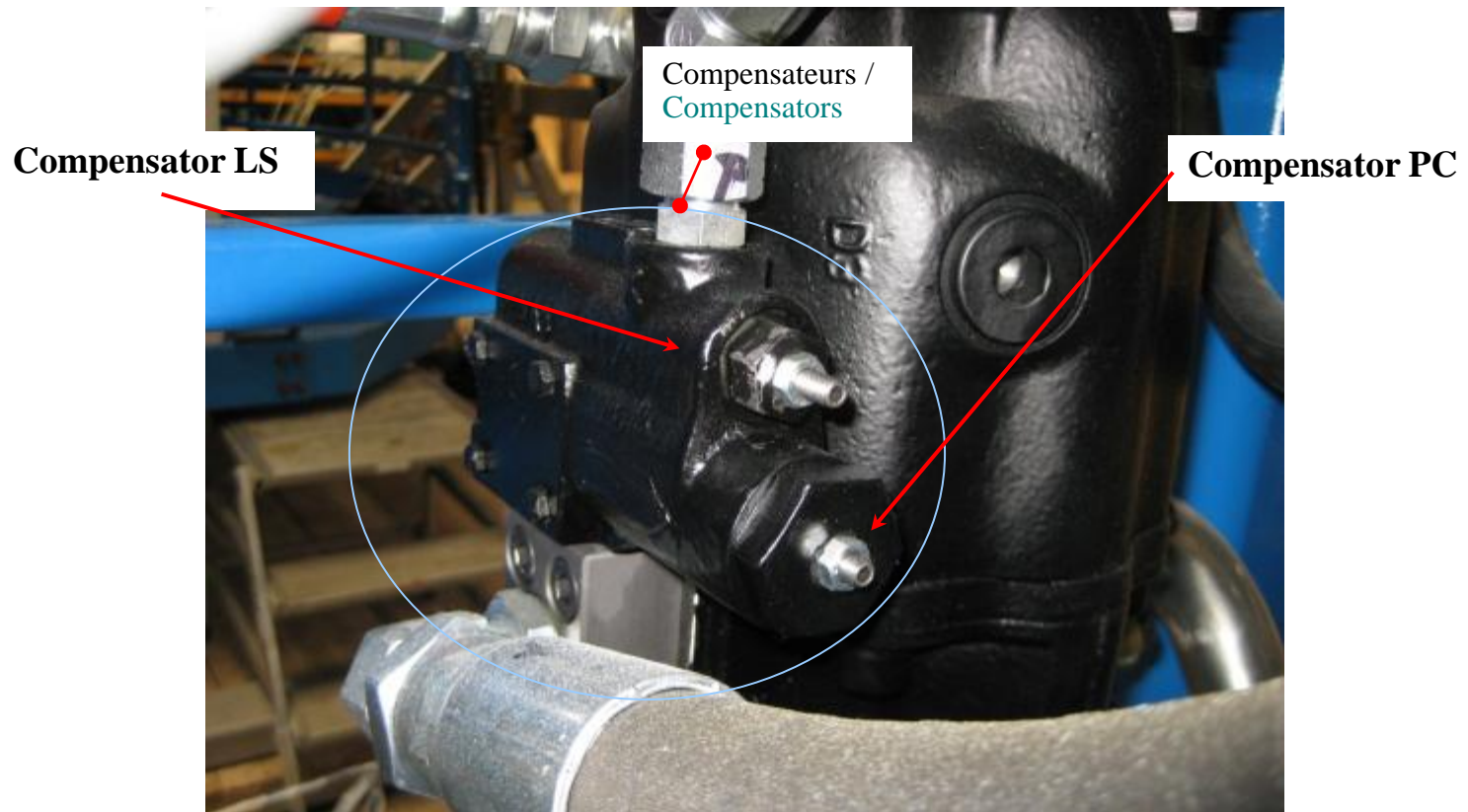


<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

COMPENSATEUR **COMPENSATOR**

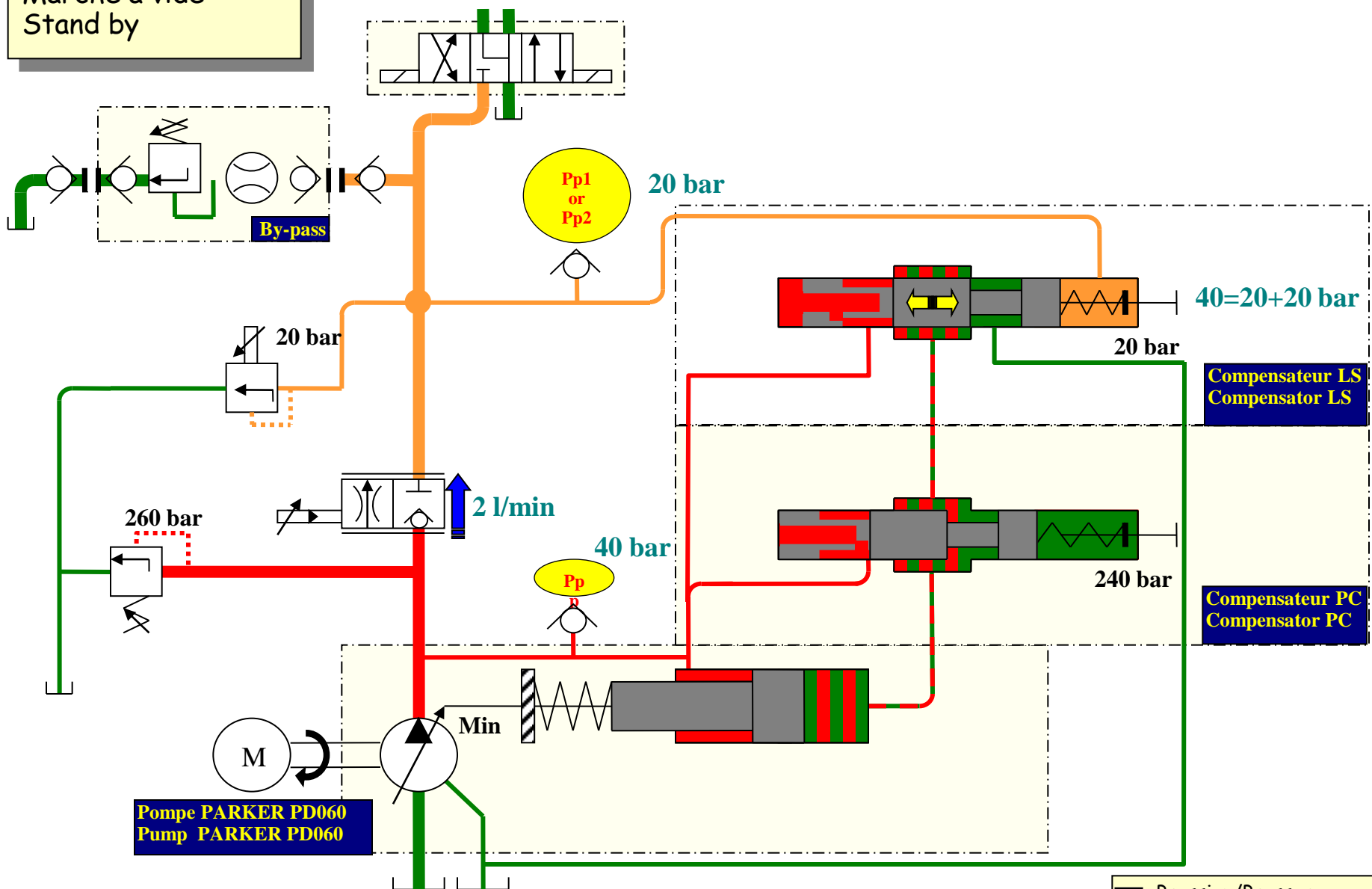
COMPENSATEUR COMPENSATOR



Un compensateur ressemble à un distributeur. La position du tiroir est déterminée par la comparaison de deux pressions: P_p et la plus forte entre P_{p1} et P_{p2}

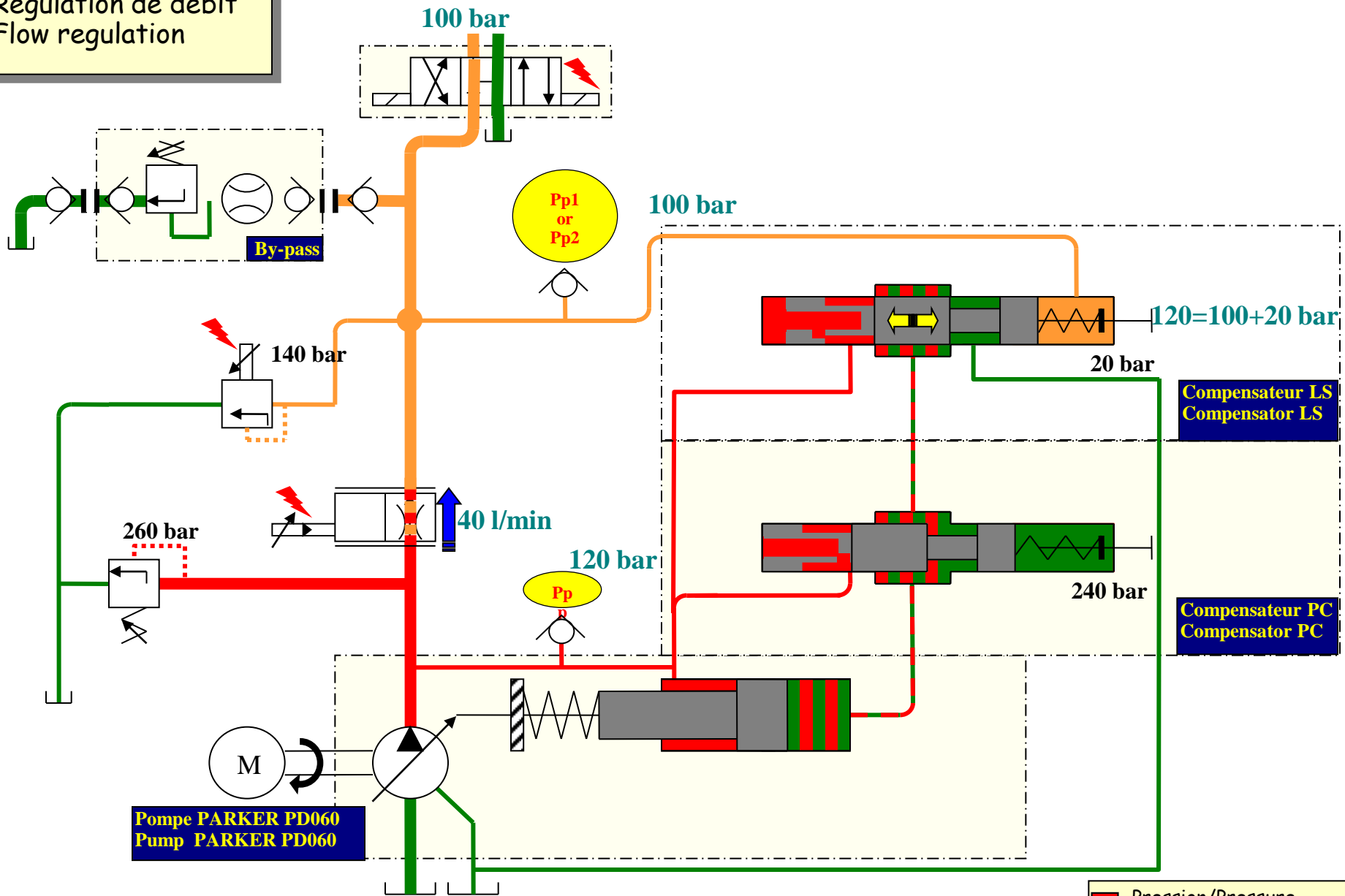
A compensator looks like a directional valve. The position of the spool depends of the difference between two pressures: P_p and the higher between P_{p1} & P_{p2} .

Marche à vide
Stand by



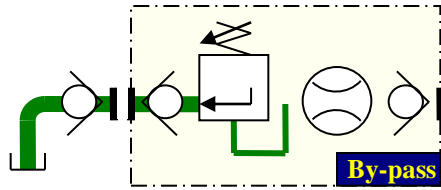
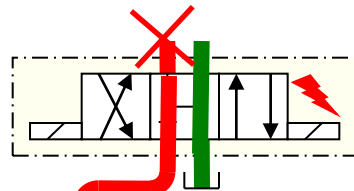
- █ Pression/Pressure
- █ Retour réservoir/Tank
- █ Pression charge/Load
- █ Circuit principal/Main
- █ Circuit pilote/Pilot

Régulation de débit Flow regulation

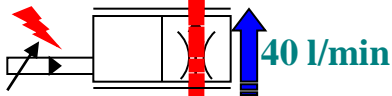
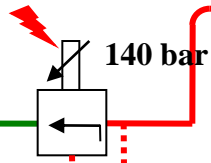


- Pression/Pressure
- Retour réservoir/Tank
- Pression charge/Load
- Circuit principal/Main
- Circuit pilote/Pilot

Butée
Bump



140 bar



260 bar

160 bar



160=140+20 bar

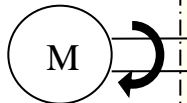
20 bar

Compensateur LS
Compensator LS



240 bar

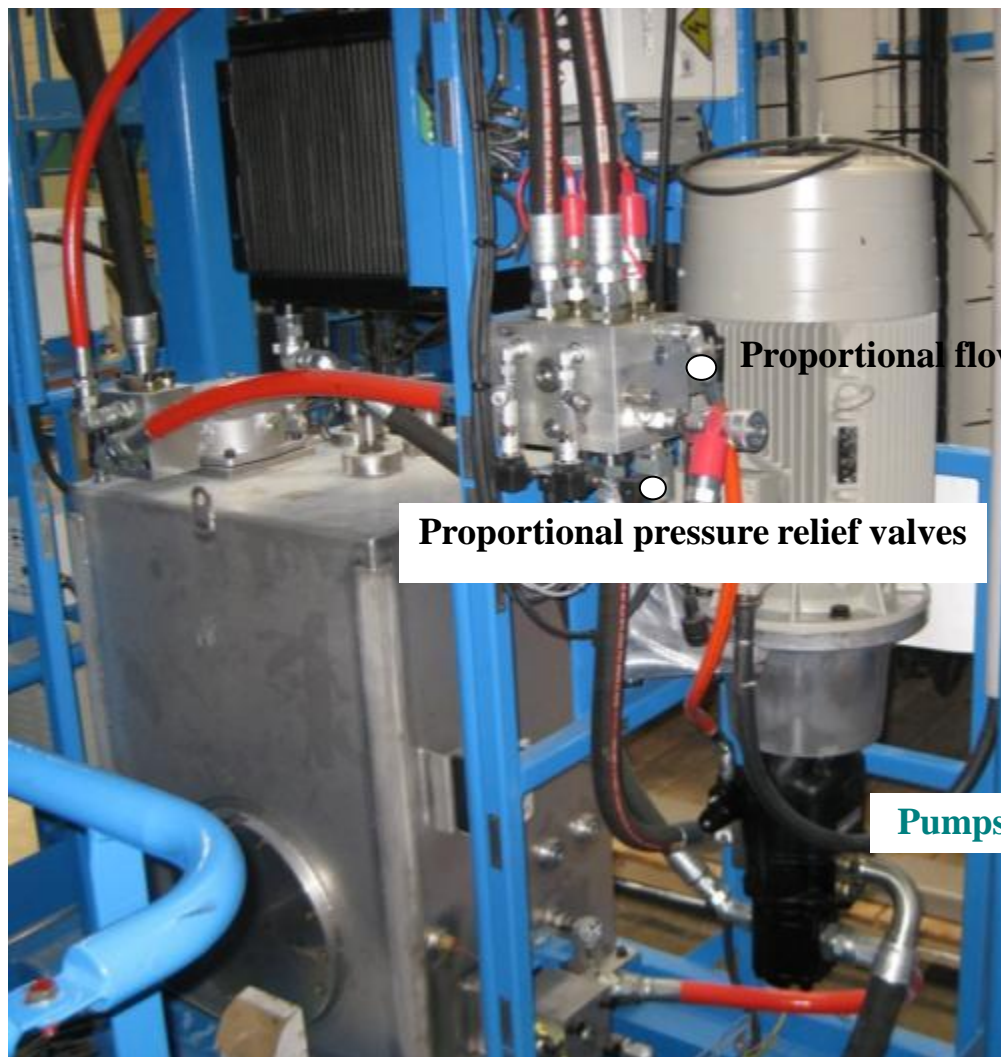
Compensateur PC
Compensator PC



Pompe PARKER PD060
Pump PARKER PD060

- Pression/Pressure
- Retour réservoir/Tank
- Pression charge/Load
- Circuit principal/Main
- Circuit pilote/Pilot

GROUPE DE POMPE PUMP GROUP

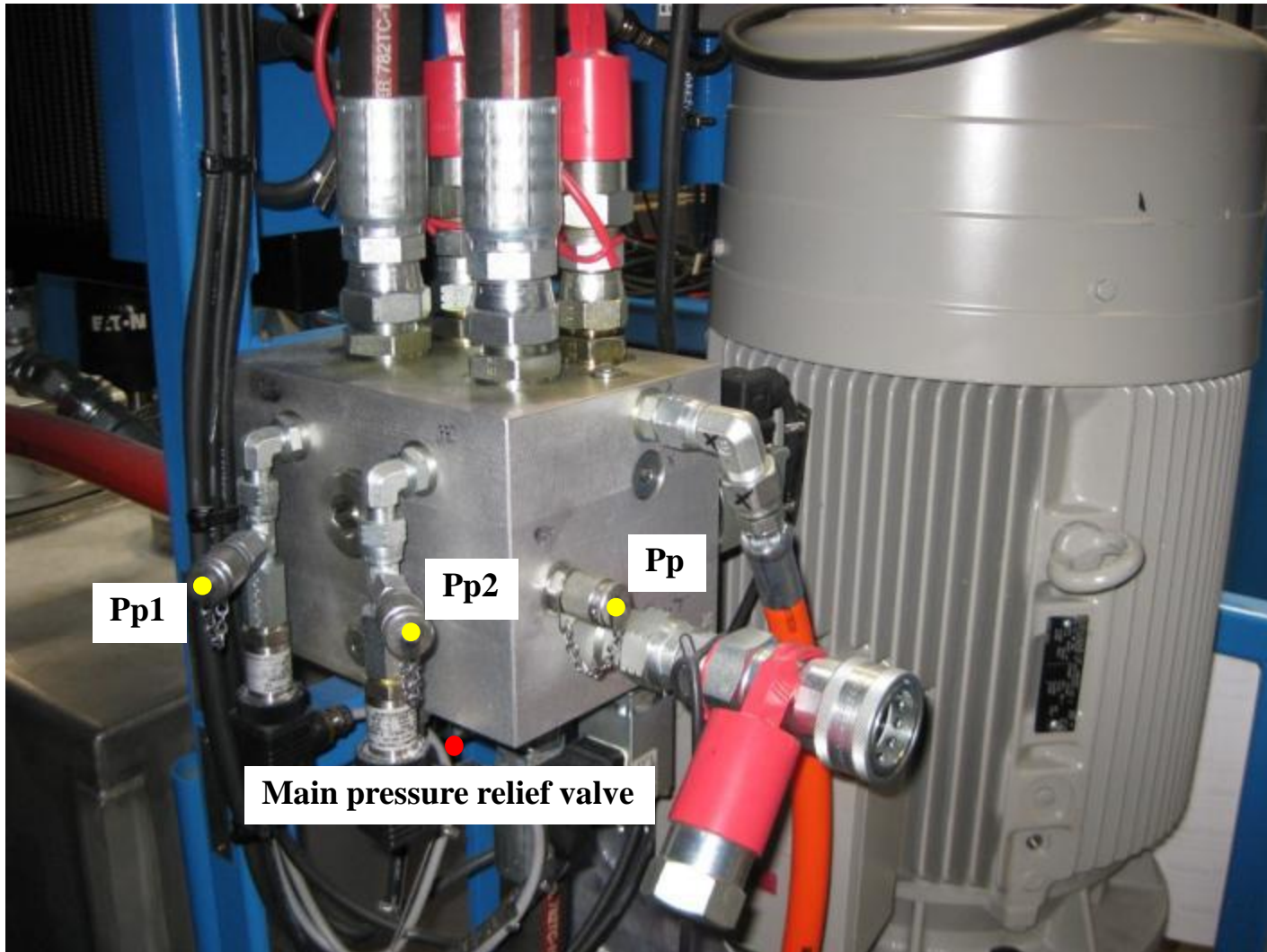


Proportional flow regulators

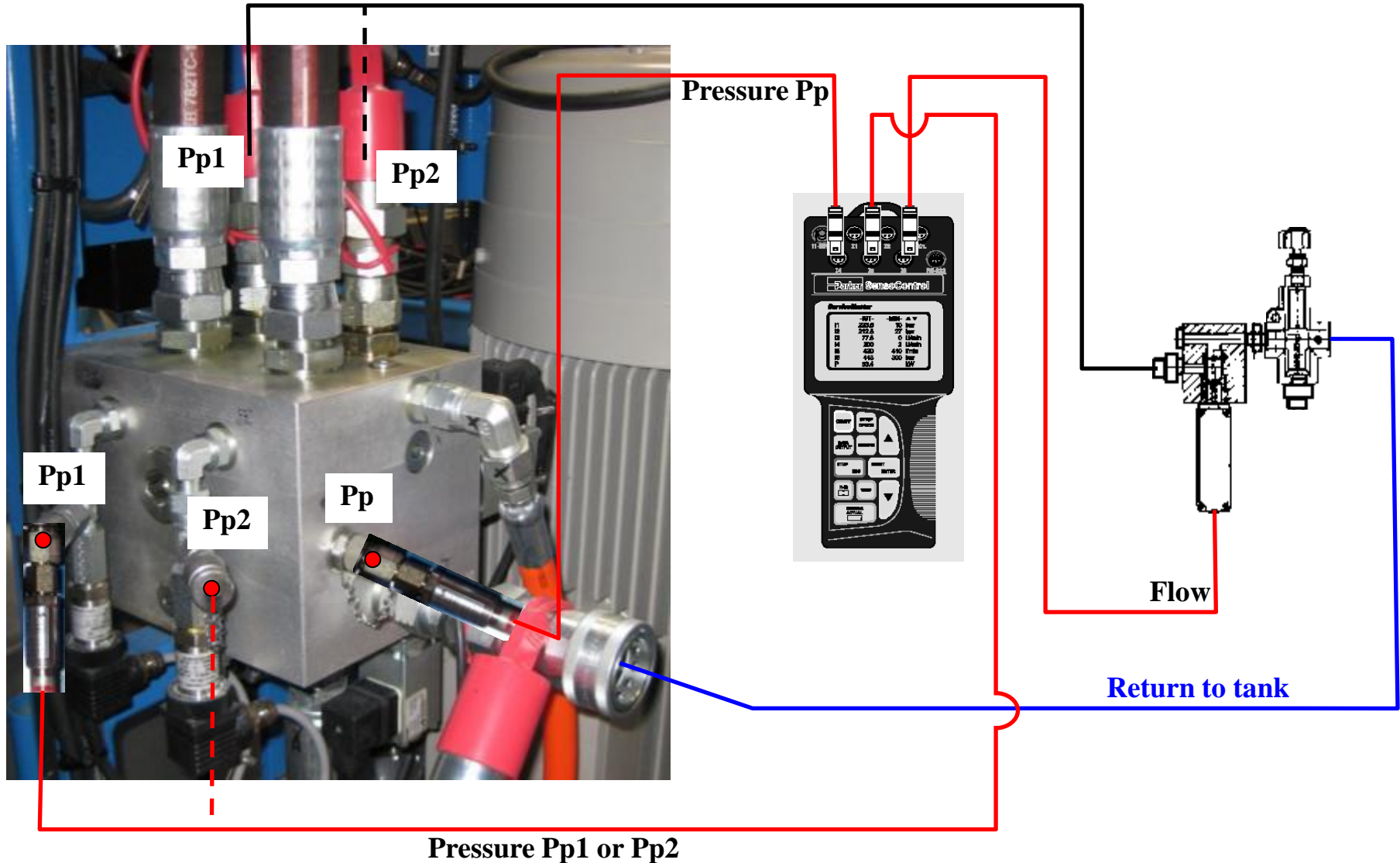
Proportional pressure relief valves

Pumps

GROUPE DE POMPES PUMPS GROUP



CONNEXION DES APPAREILS DE RÉGLAGE CONNECTION OF TOOLS FOR ADJUSTMENT



AJUSTEMENT DES COMPENSATEURS

COMPENSATORS ADJUSTMENT

Réglage du compensateur LS
Compensator LS adjustment

Delta P = 20
+/-2 Bar

Réglage du limiteur de pression
Relief valve adjustment

260 Bar

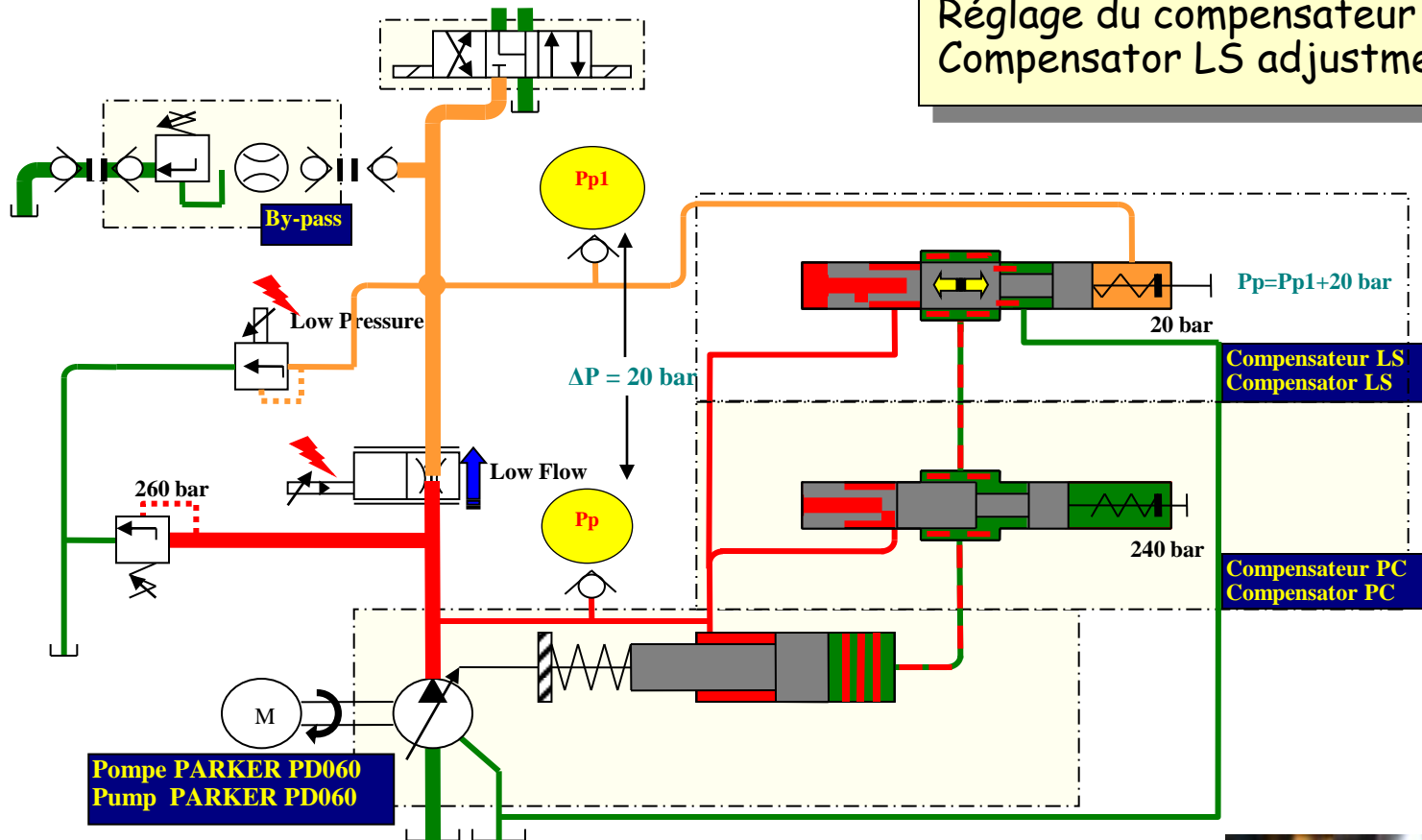
Réglage du module %P et %D
%P & %F module adjustment

I mini = 20 bar / 2 L/min
I max = 250 bar / 65 L/min

Réglage du compensateur PC
Compensator PC adjustment

240 Bar

Réglage du compensateur LS Compensator LS adjustment



Starting motor

Select HU calibration view on Panel View (Line P1 or Line P2)

By-pass circuit open

1 Mvt activated (5 V in pressure)

1 Mvt activated (6 V in flow)

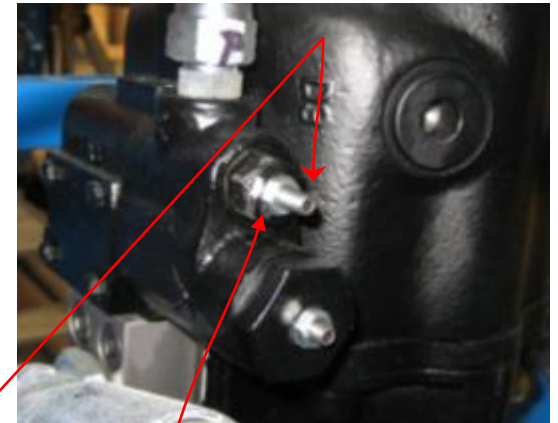
Adjust bypass to obtain **50 bars** on Pp1 or Pp2

Adjust flow setting to obtain **30 L/min**

Adjust ΔP between Pp & Pp1/Pp2. ΔP must be at 20 (+/-2) bar

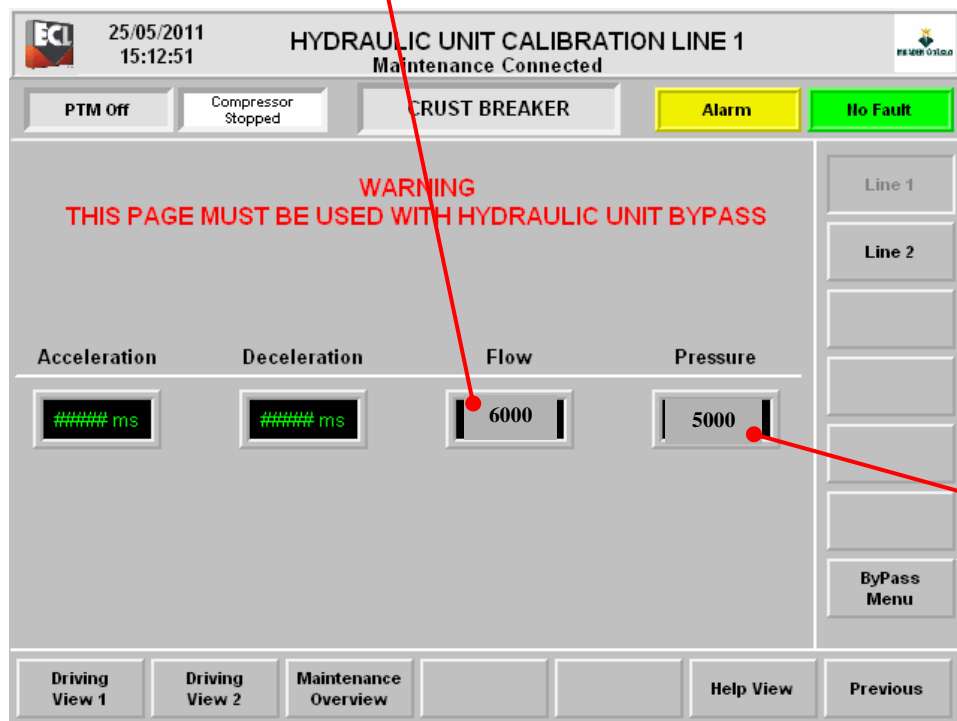
Lock with nut

NOTA: Always finish the adjustment by tightening (clockwise direction)

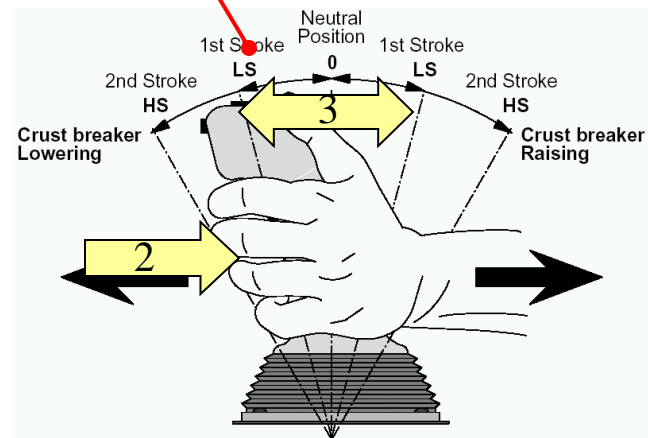


- 1 Mvt activated (6 V in flow)
- Adjust flow setting value to obtain 30 l/mn

Réglage du compensateur LS
Compensator LS adjustment

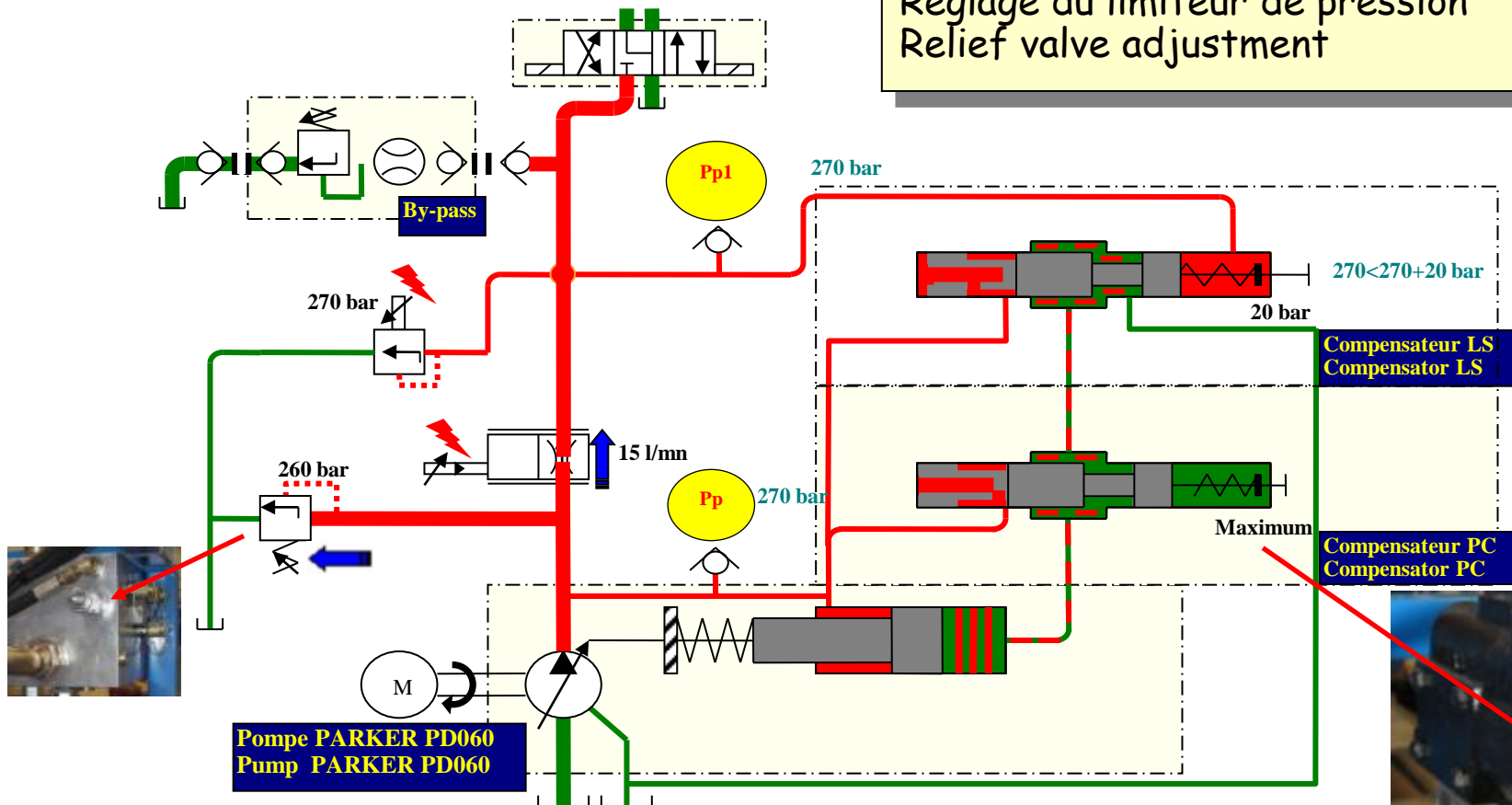


1 Mvt activated (5 V in pressure)



Select calibration view for Line P1 or Line P2

Réglage du limiteur de pression Relief valve adjustment



Before starting the motor

1. Select HU calibration view on Panel View
2. By-pass circuit open
3. Tighten the safety valve at maximum
4. Tighten the compensator PC at maximum
5. 1 Mvt activated (4 V in pressure)

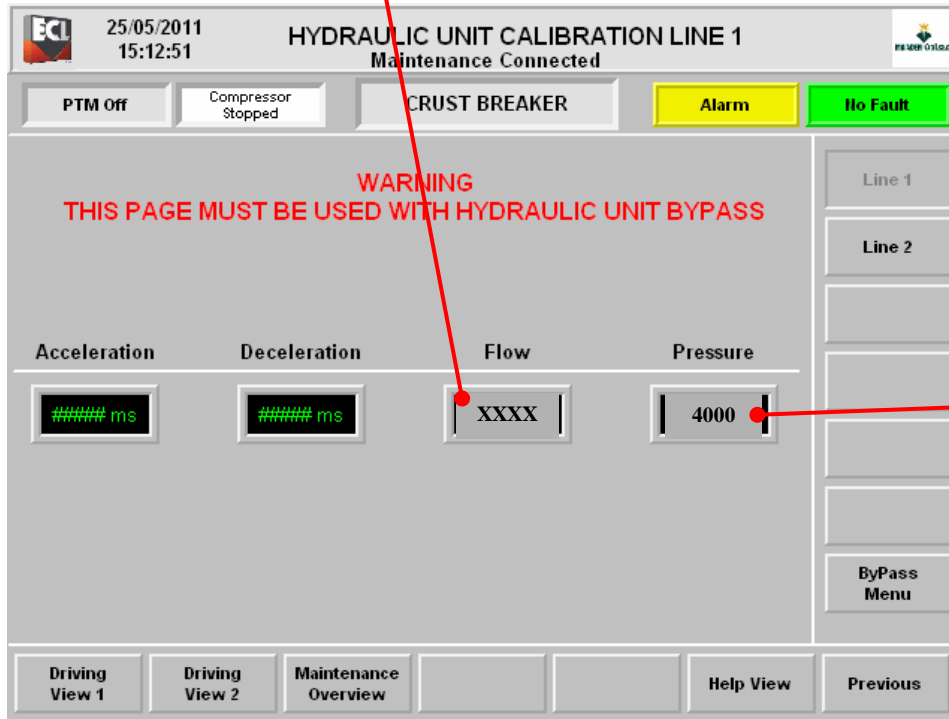
Starting motor

6. Adjust flow setting to obtain **15 L/min**
7. Tighten fully pressure limiter on By-pass
8. Adjust the pressure set value to obtain $260 + 10 \text{ bar} = 270 \text{ bar}$ on Pp1 or Pp2

9. Read the motor current on the clamp meter
 10. Loosen the safety valve until to see an increasing of the motor current value, that involves a light decreasing of the pressure : the opening point is adjusted
 11. Open fully pressure limiter on By-pass
- NOTA: Always finish the adjustment by tightening (clockwise direction)**

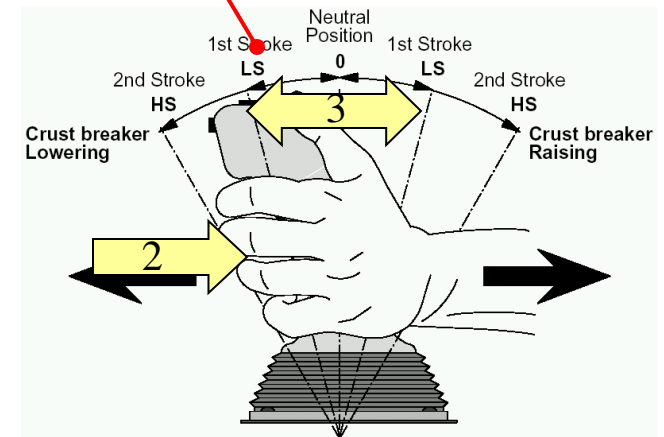
Adjust flow setting value to obtain 15 l/mn

Réglage du limiteur de pression
Relief valve adjustment



- 1 Mvt activated (4 V in pressure)
- Adjust pressure setting value to obtain 270 bar

Select calibration view for Line 1 or Line 2





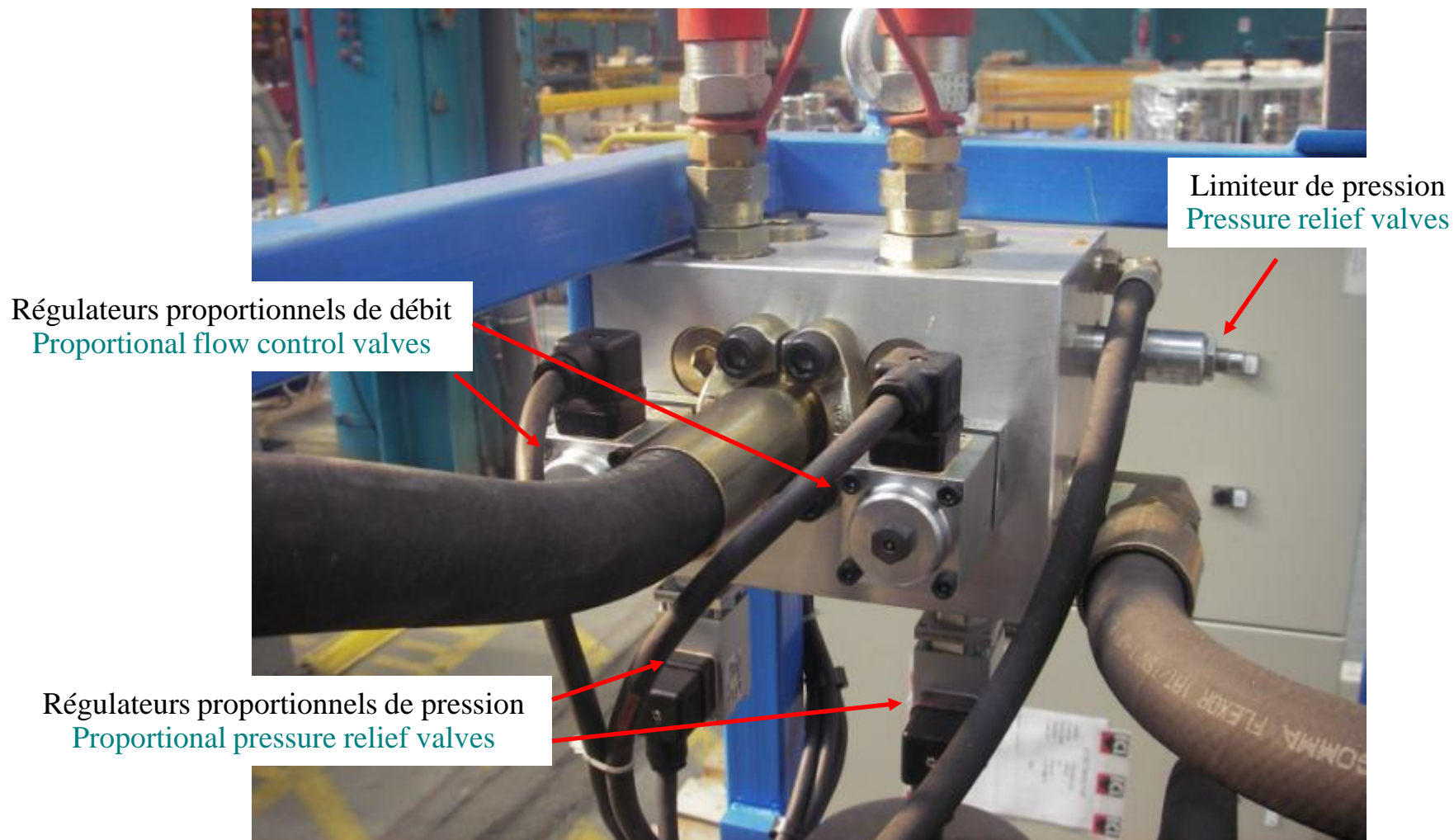
<http://www.ecl.fr>

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

REGLAGES
MODULES DEBIT - PRESSION
ADJUSTMENT
FLOW & PRESSURE
MODULES

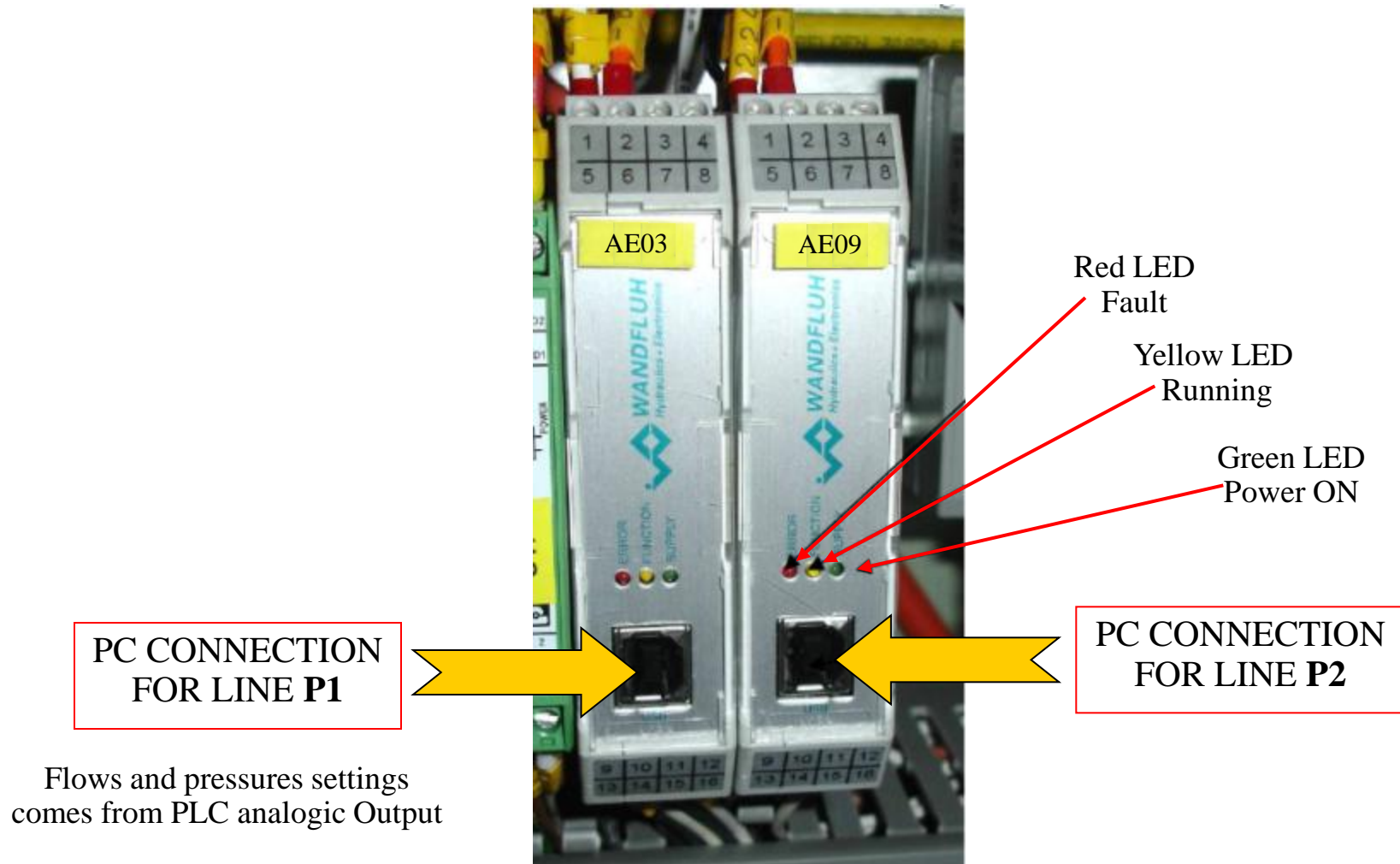
BLOC DE REGULATION

REGULATION MANIFOLD



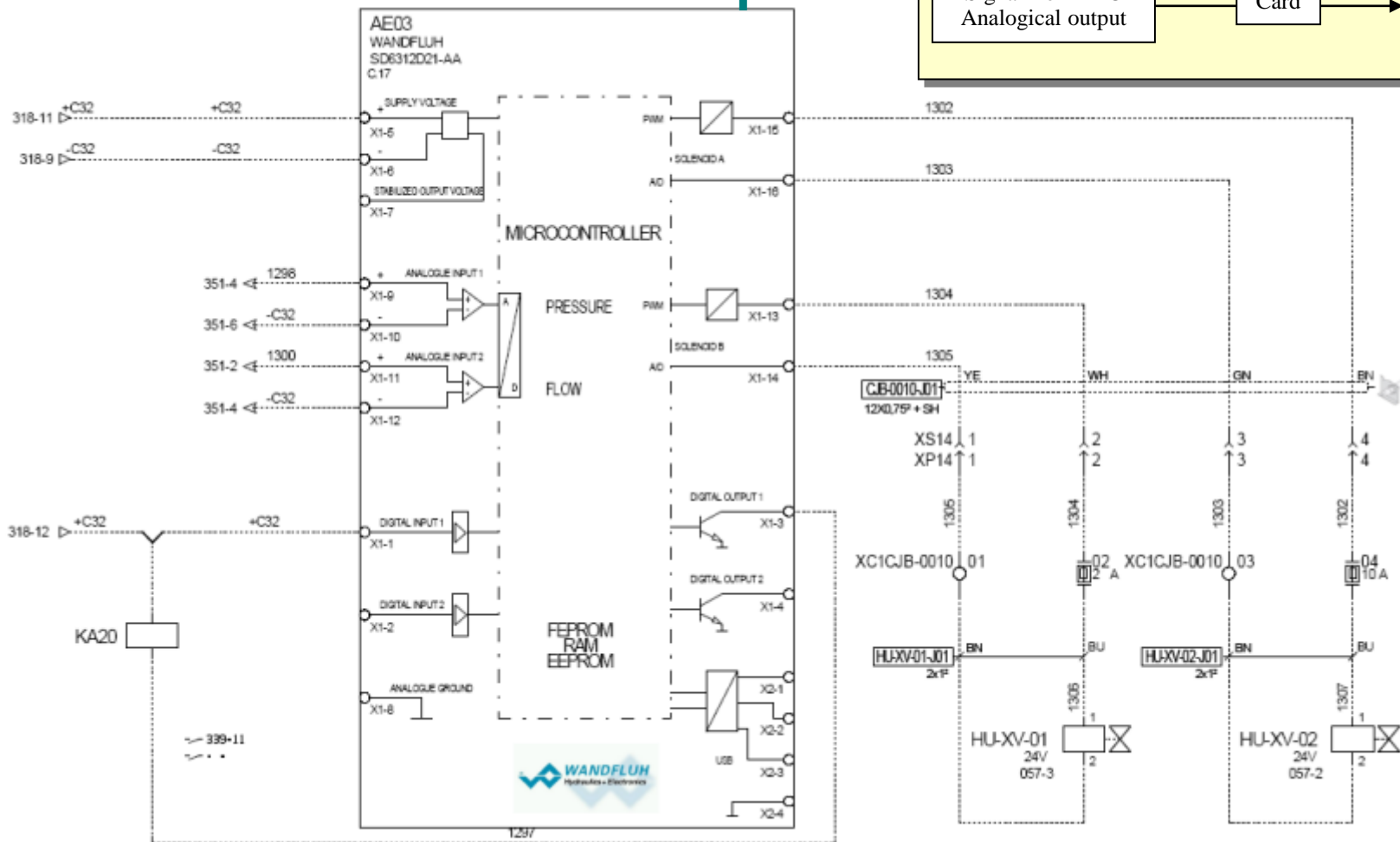
MODULES DEBITS / PRESSIONS

FLOW / PRESSURE MODULES



MODULE “SD6312 D21 AA” (débit, pression)

MODULE “SD6312 D21 AA” (flow. pressu



CONSIGNES DEBITS / PRESSIONS FLOW / PRESSURE SETTINGS

Start the software :
"C:\Program Files\PasoDSVSD6v1502\Paso.exe"



**PASO DSV / SD6
for Windows**

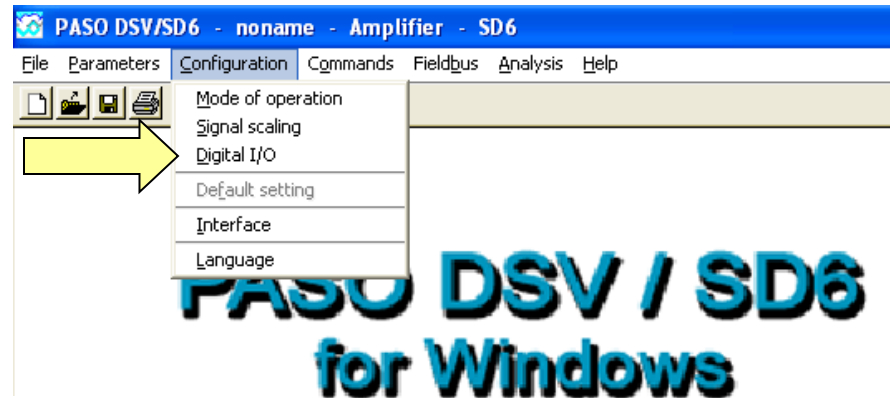


Ethernet Cable (RJ45)

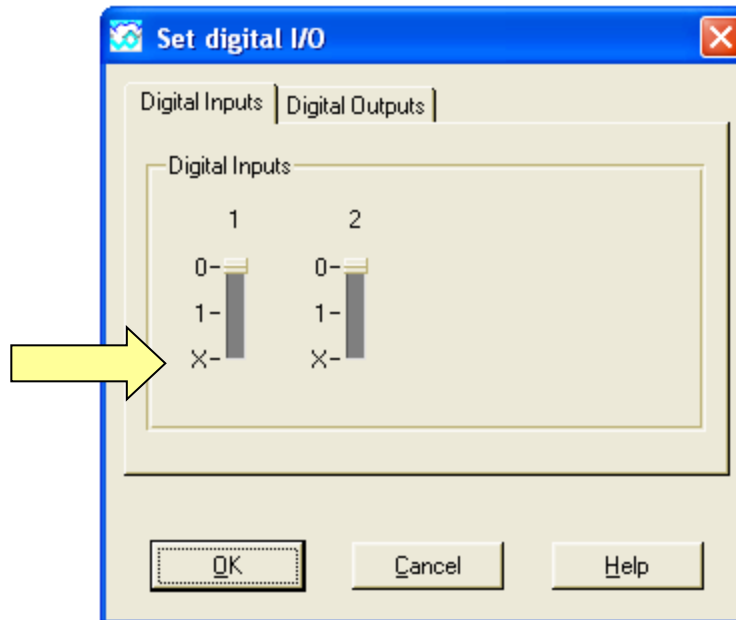
CONSIGNES DEBITS / PRESSIONS

FLOW / PRESSURE SETTINGS

1 - Select « Digital I/O »



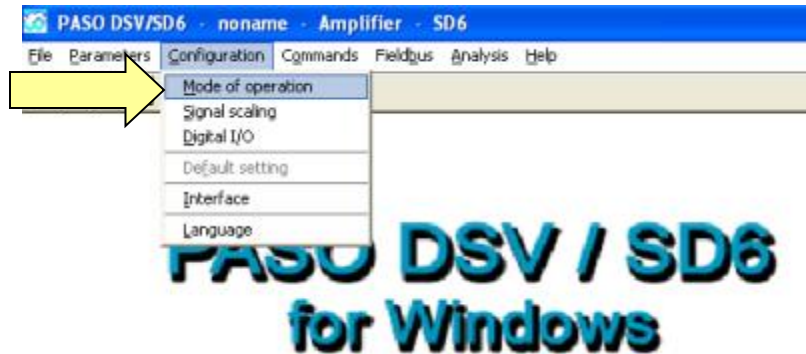
2 - Move to x



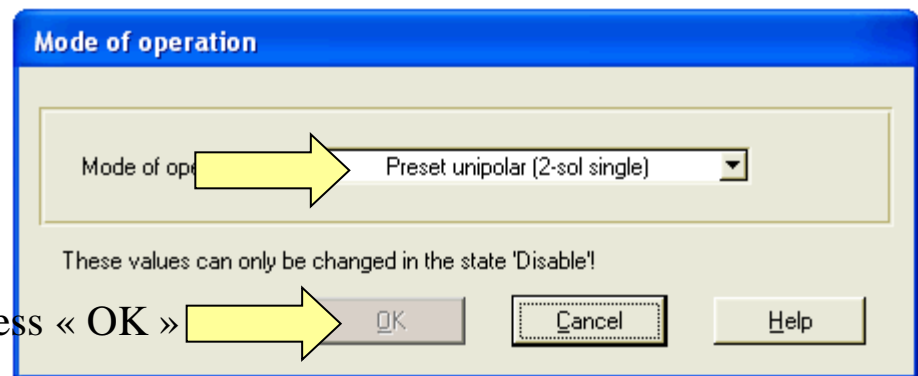
3 - Green LED
Power ON
ONLY

CONSIGNES DEBITS / PRESSIONS FLOW / PRESSURE SETTINGS

1 - Select « Mode of operation »



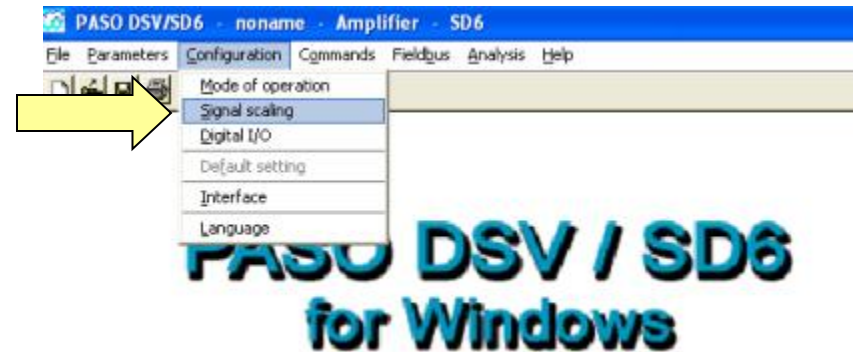
2 – Select « Preset unipolar (2-sol single) »



3 – Press « OK »

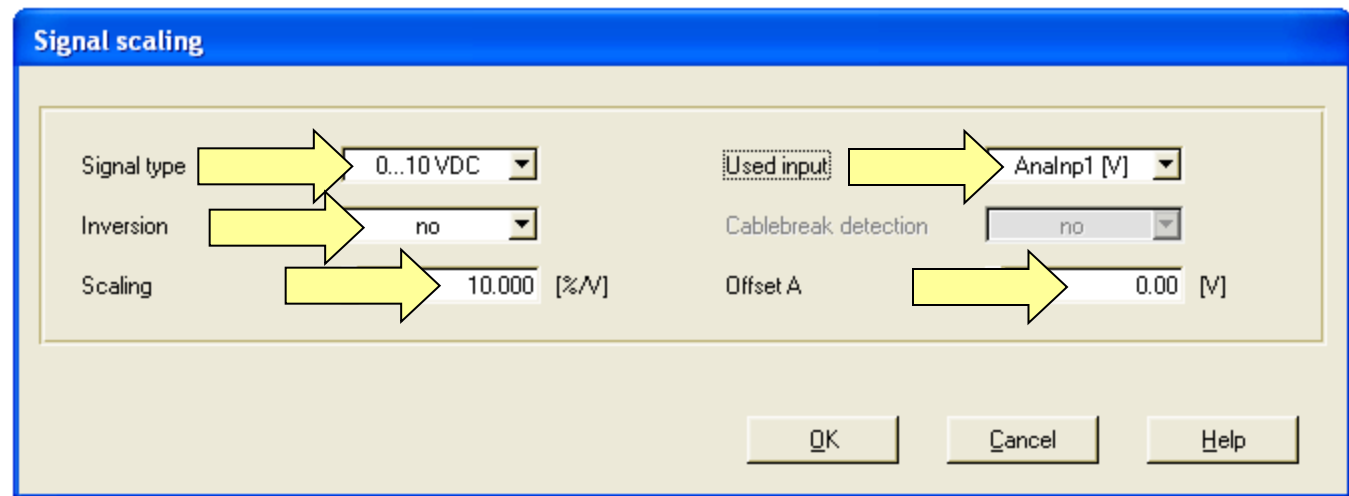
CONSIGNES DEBITS / PRESSIONS FLOW / PRESSURE SETTINGS

1 - Select « Signal scaling »



Chanel A & B identical

2 – Set up



CONSIGNES DEBITS / PRESSIONS

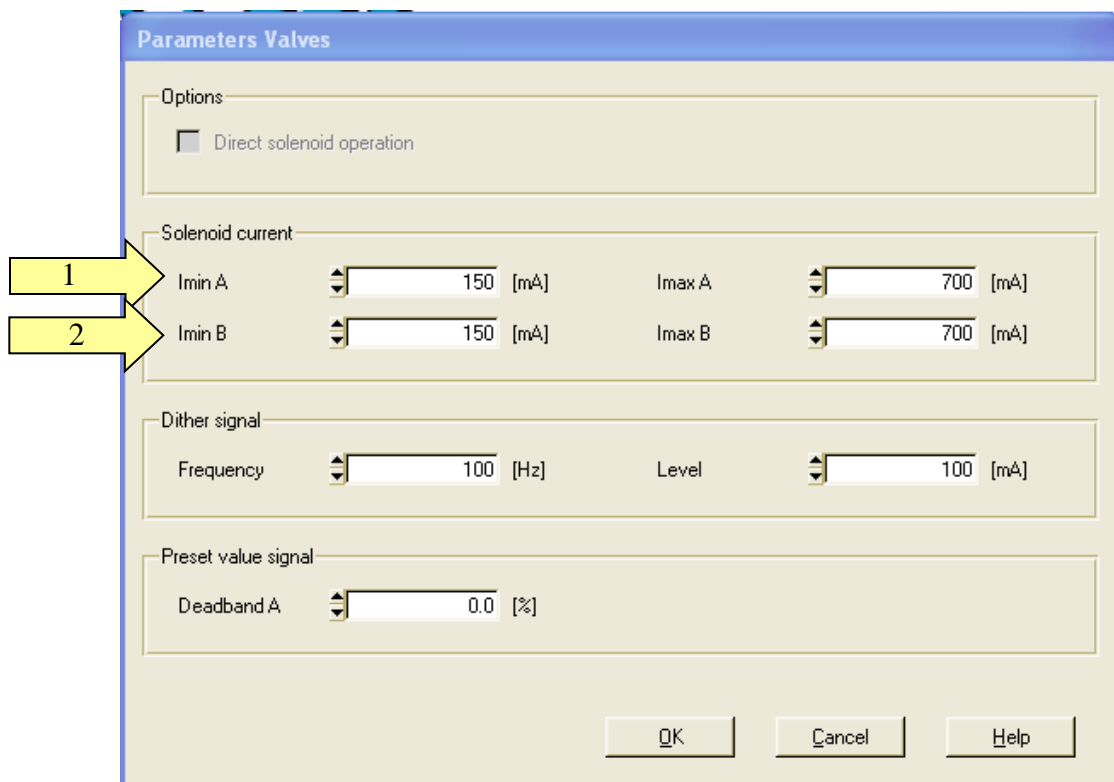
FLOW / PRESSURE SETTINGS

1 - Select « Valves »



PASO DSV / SD6
for Windows

Pressure valve A
Flow valve B



Parameters Valves

Options

☐ Direct solenoid operation

Solenoid current

Imin A: 150 [mA] Imax A: 700 [mA]

Imin B: 150 [mA] Imax B: 700 [mA]

Dither signal

Frequency: 100 [Hz] Level: 100 [mA]

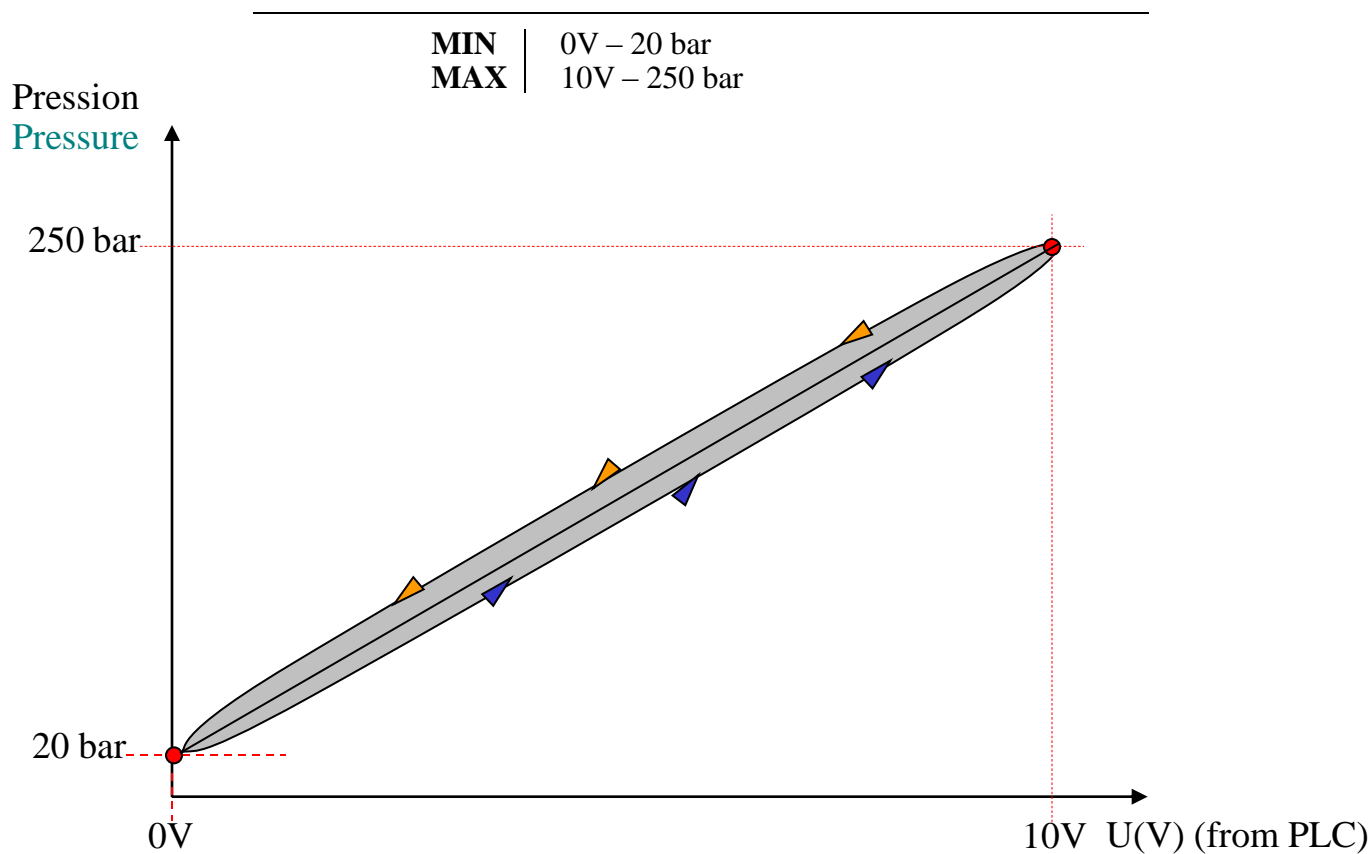
Preset value signal

Deadband A: 0.0 [%]

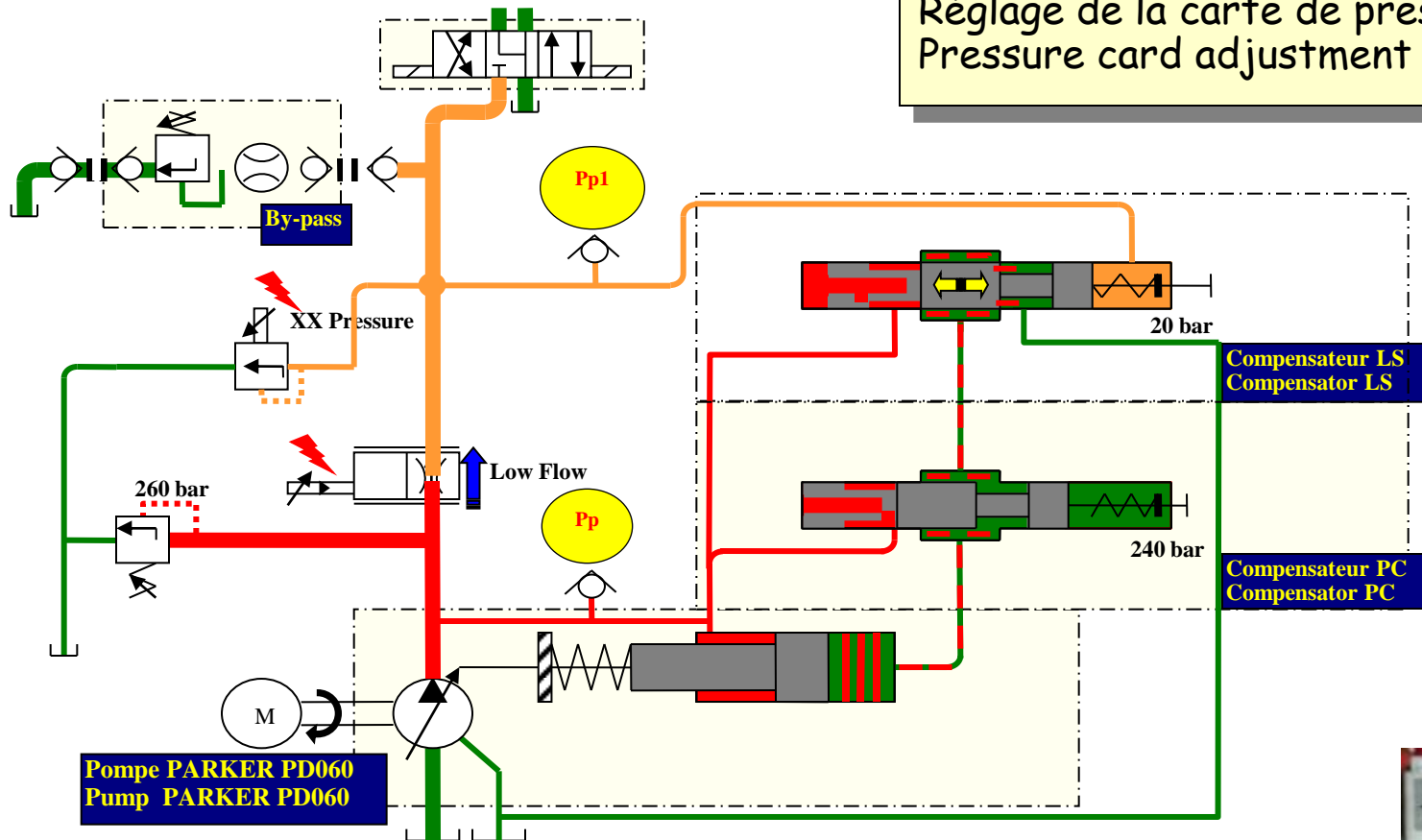
OK Cancel Help

Ajustement pression Pressure Adjustment

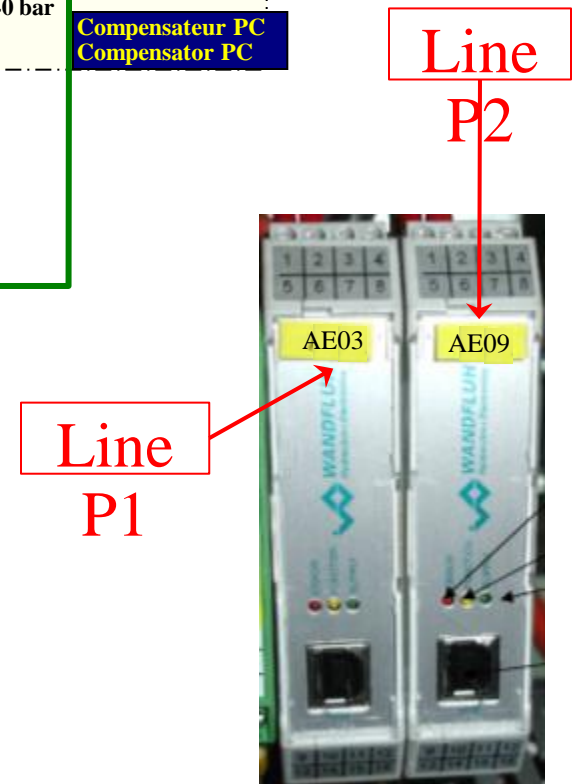
Ajustement du point d'ouverture et de l'ouverture maximale de la valve BVP
Adjustment of the opening point and the maximum opening of the BVP valve



Réglage de la carte de pression Pressure card adjustment

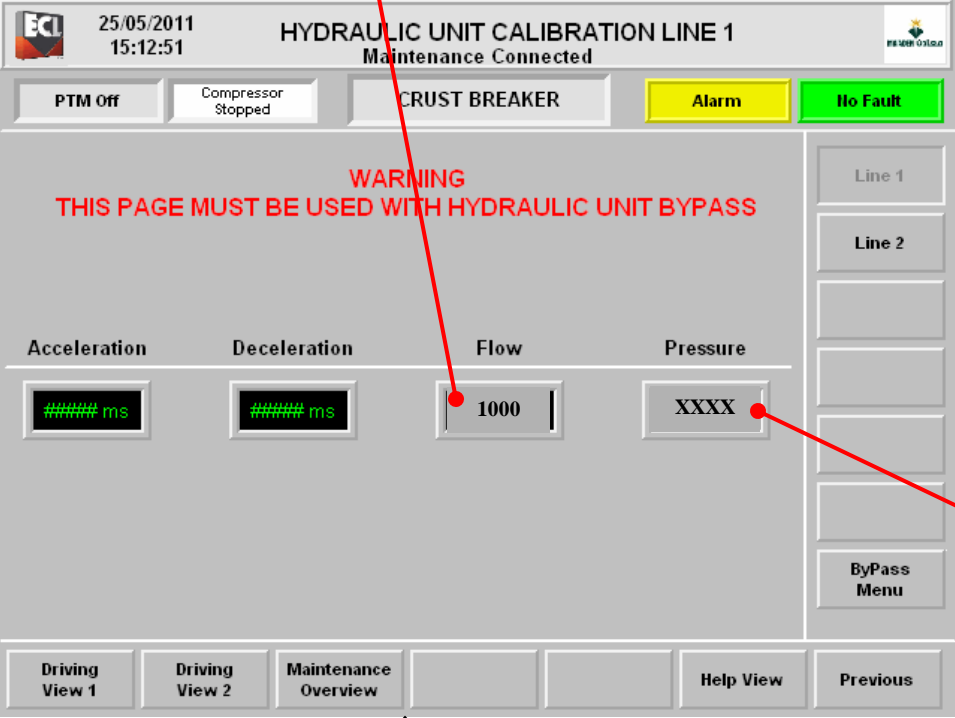


1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. 1 Mvt activated (1 V in flow)
3. Adjust the pressure setting value to 0V on Panel view
4. Tighten fully pressure limiter on By-pass
5. Adjust the I Min A to obtain 20 bar on Pp1 or Pp2
6. Adjust the pressure setting value to 10V on Panel view
7. Adjust the I Max A to obtain 250 bar on Pp1 or Pp2 (Approx. 500 mA)
8. Verify 0V → 20 bar
9. Verify 10V → 250 bar
10. Auto adjust of analogical pressure sensor



Réglage de la carte de pression Pressure card adjustment

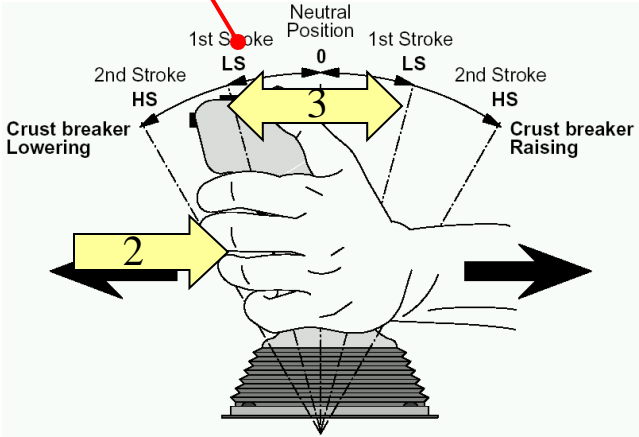
Adjust flow setting at 1 V



1 Mvt activated (0V or 10V in pressure)

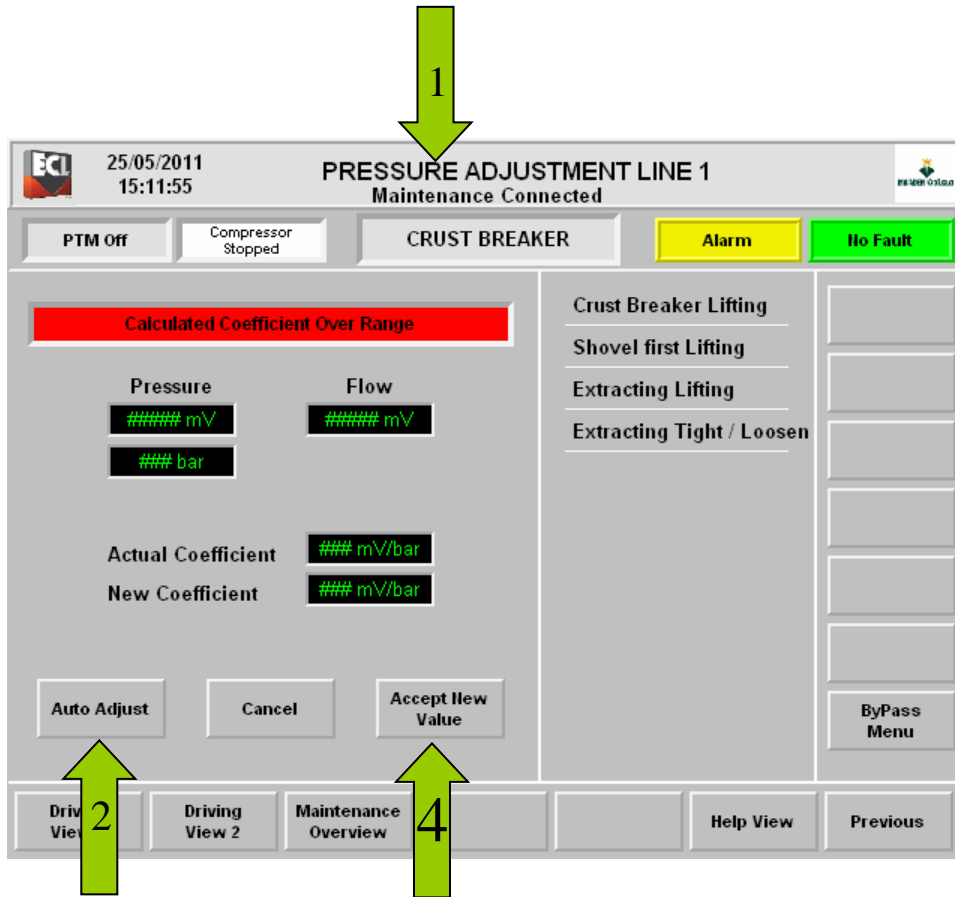


Select calibration view for Line 1 or Line 2



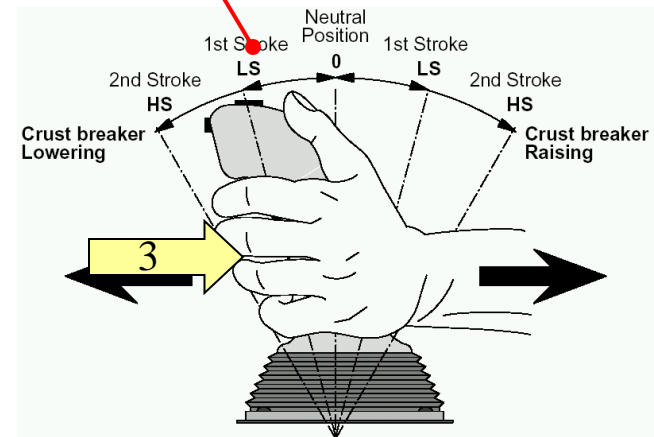
Select pressure adjustment view for Line 1 or Line 2

Réglage capteur pression
Pressure sensor adjustment



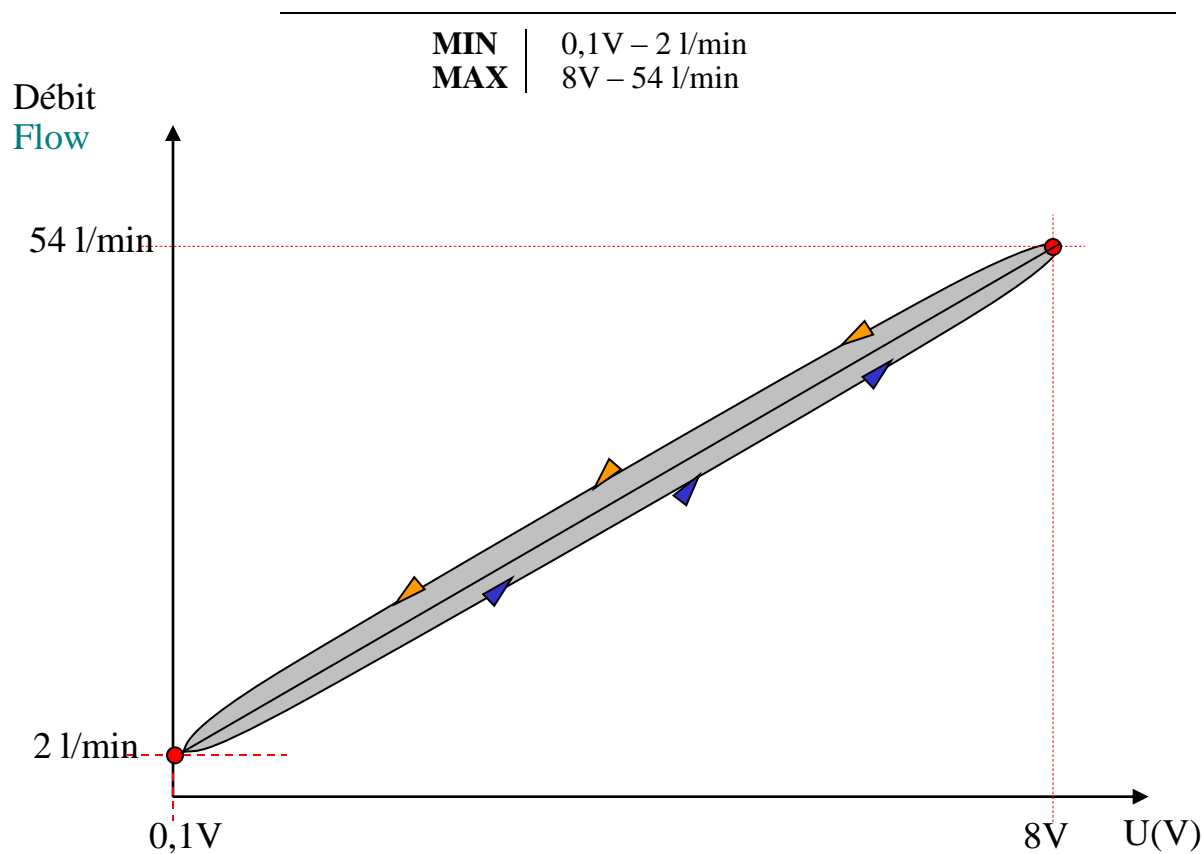
Press Auto Adjust button for Line 1 or Line 2

Press dead man only

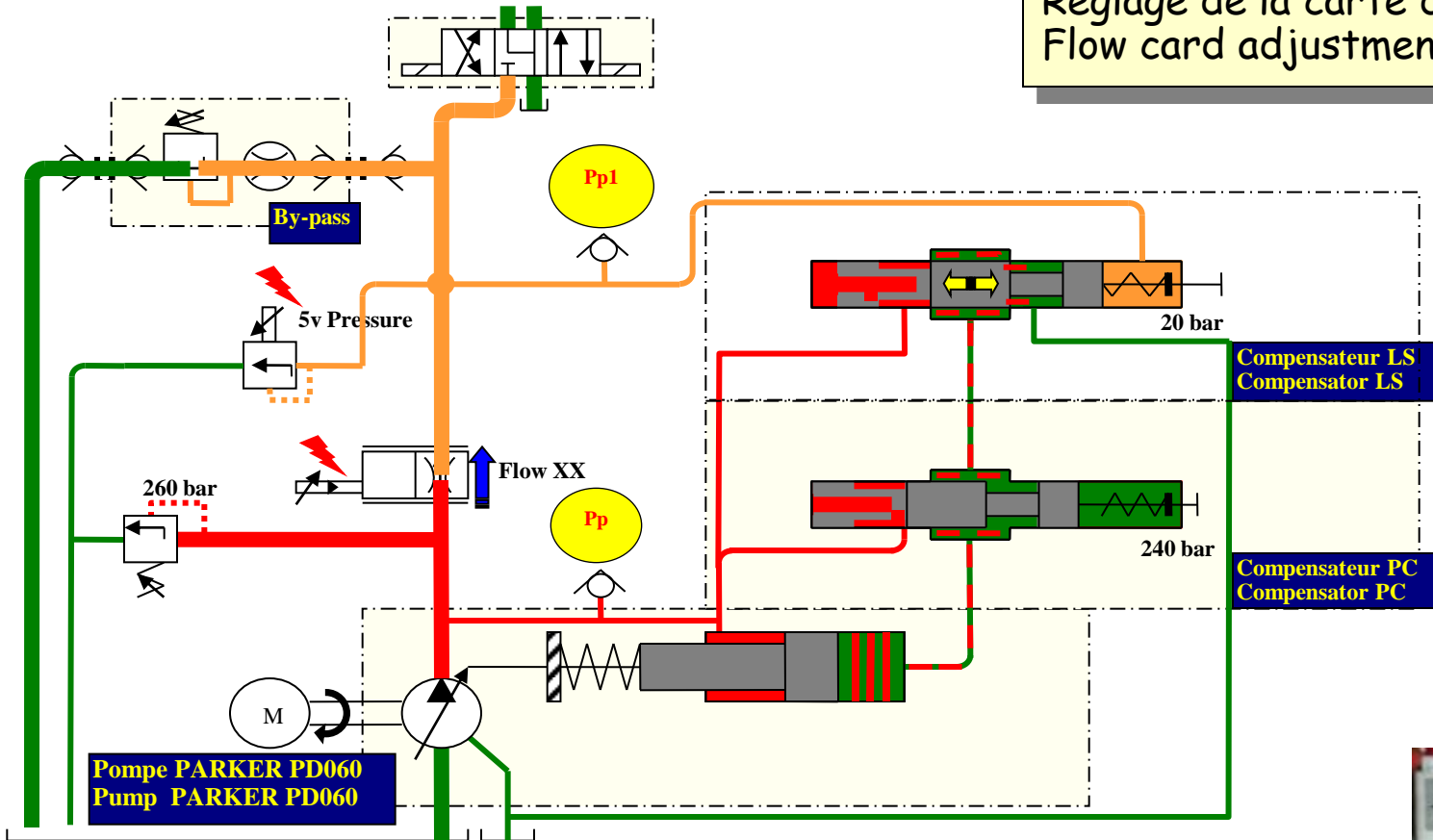


Ajustement débit Flow adjustment

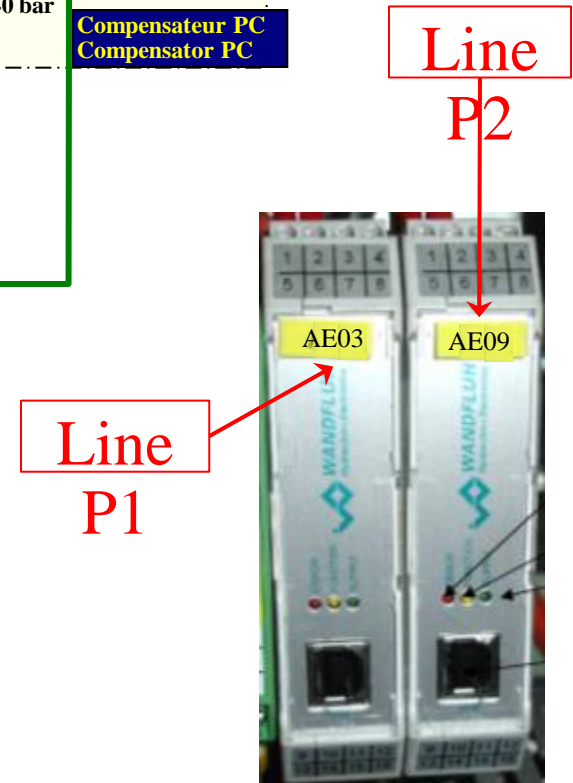
Ajustement du point d'ouverture et de l'ouverture maximale de la valve QNP
Adjustment of the opening point and the maximum opening of the QNP valve



Réglage de la carte de débit Flow card adjustment

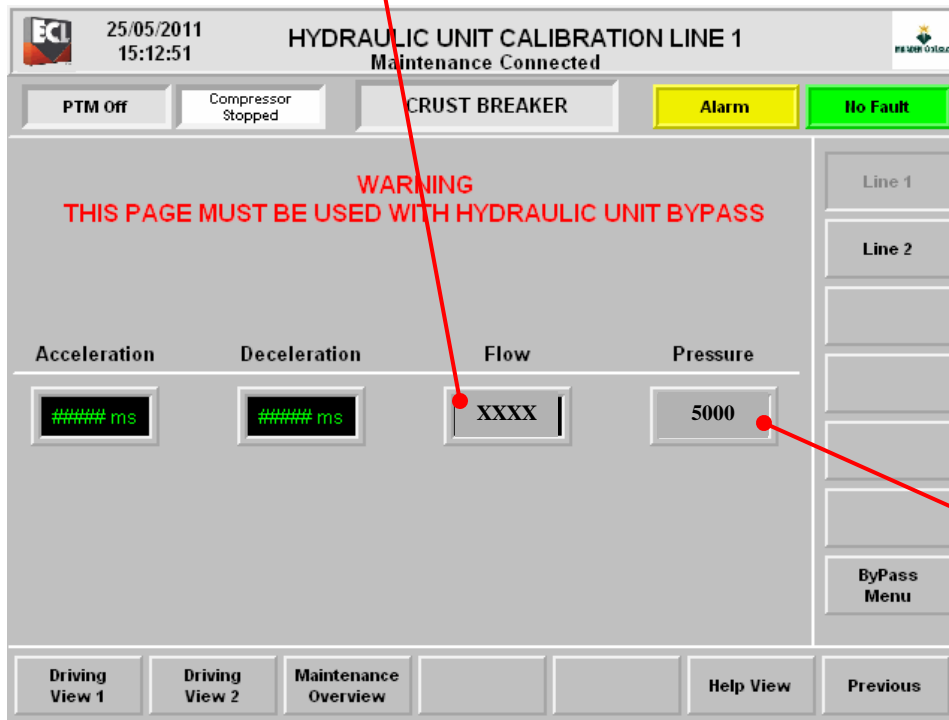


1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. Open fully pressure limiter on By-pass
3. 1 Mvt activated (5 V in pressure)
4. Adjust the flow setting value to 0,1V on Panel view
5. Adjust the I Min B to obtain 2 l/min on the flow meter
6. Adjust the flow setting value to 8V on Panel view
7. Adjust the I Max B to obtain 54 l/min on the flow meter
8. Verify 0,1V → 2 l/min
9. Verify 8V → 54 l/min

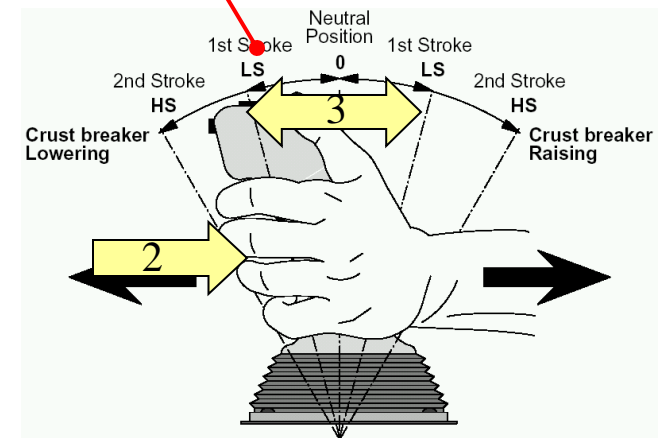


Adjust flow setting at 0,1V or 8V

Réglage de la carte de débit
Flow card adjustment

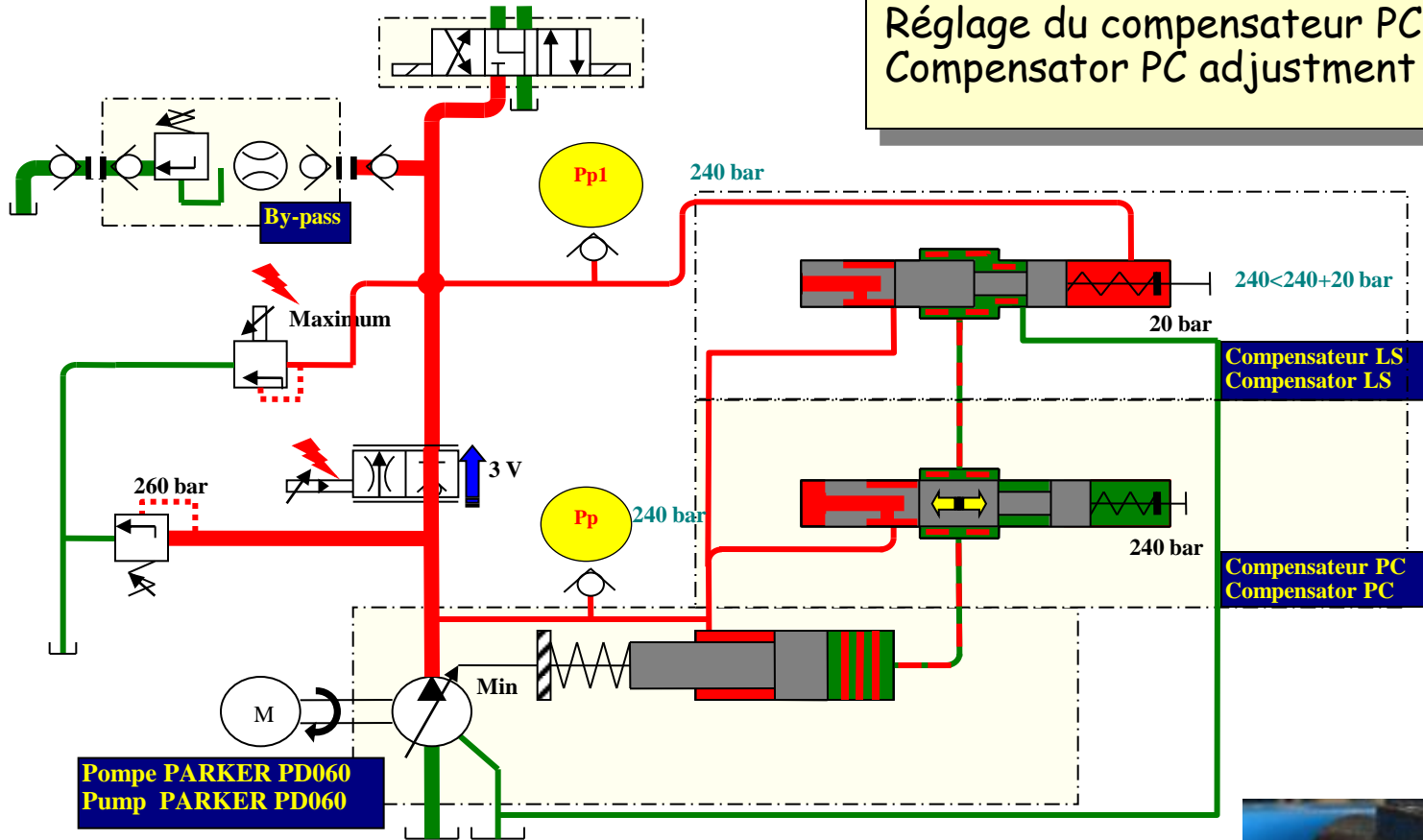


1 Mvt activated (5V in pressure)

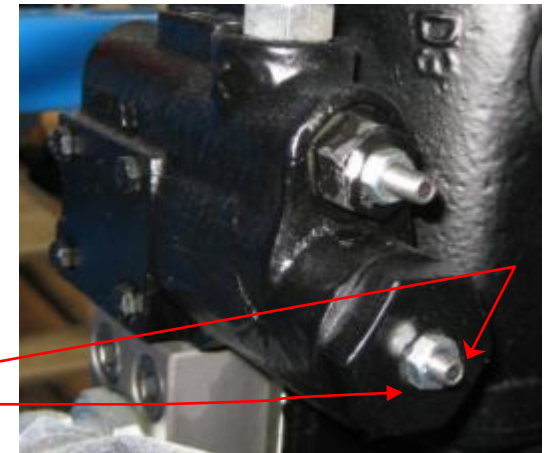


Select calibration view for Line 1 or Line 2

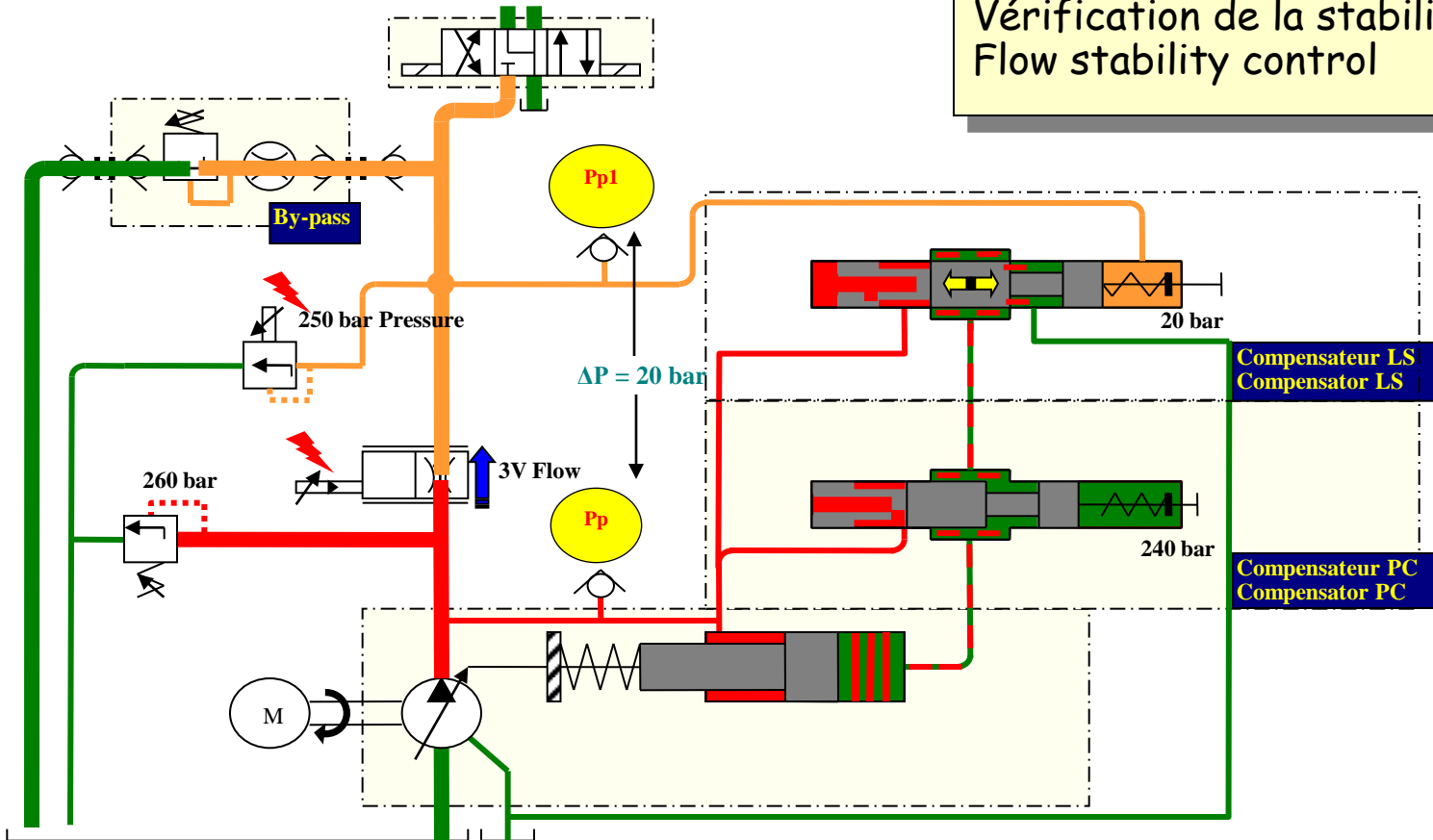
Réglage du compensateur PC Compensator PC adjustment



1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. Open fully pressure limiter on By-pass
3. 1 Mvt activated (adjust 10V in pressure & 3V in flow)
4. Tight fully pressure limiter on By-pass
5. Loosen the high pressure compensator (PC) until to reach 240 bar on Pp
6. Lock with nut



Vérification de la stabilité du débit Flow stability control



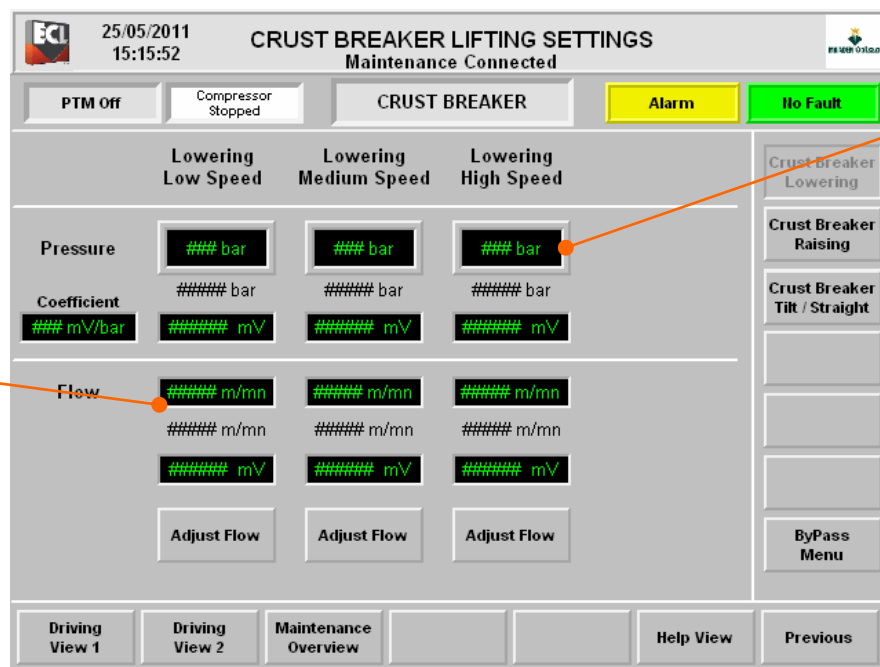
Starting motor

1. Select HU calibration view on Panel View (Line P1 or Line P2)
2. Connect the by pass circuit
3. Open fully the relief valve of the by pass circuit
4. 1 Mvt activated
5. Adjust the pressure setting value to 10V on Panel view
6. Adjust the flow setting value to 3V on Panel view
7. Increase pressure with the relief Valve from 20 to 220 bar read on Pp1 or Pp2.
8. Control that flow value is stable (+- 2 l/min)
9. Control that the ΔP is stable (20 bar +- 2 bar)

MOVEMENT FLOW & PRESSURE SETTINGS

Step 2 = FLOW settings:

- The flow setting value must be adjust as per speed on the data sheet indicated in the maintenance manual.



Flow setting value in m/min

Pressure setting value in bar

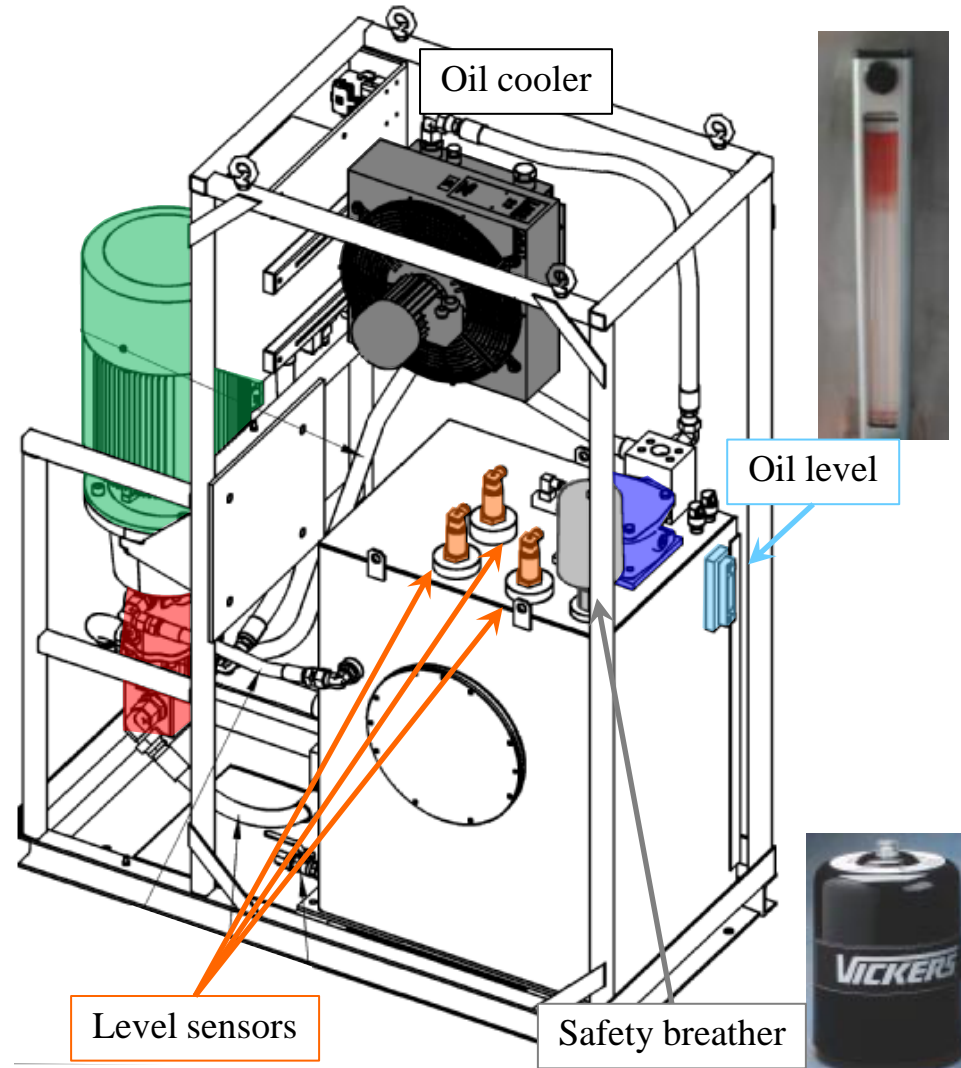
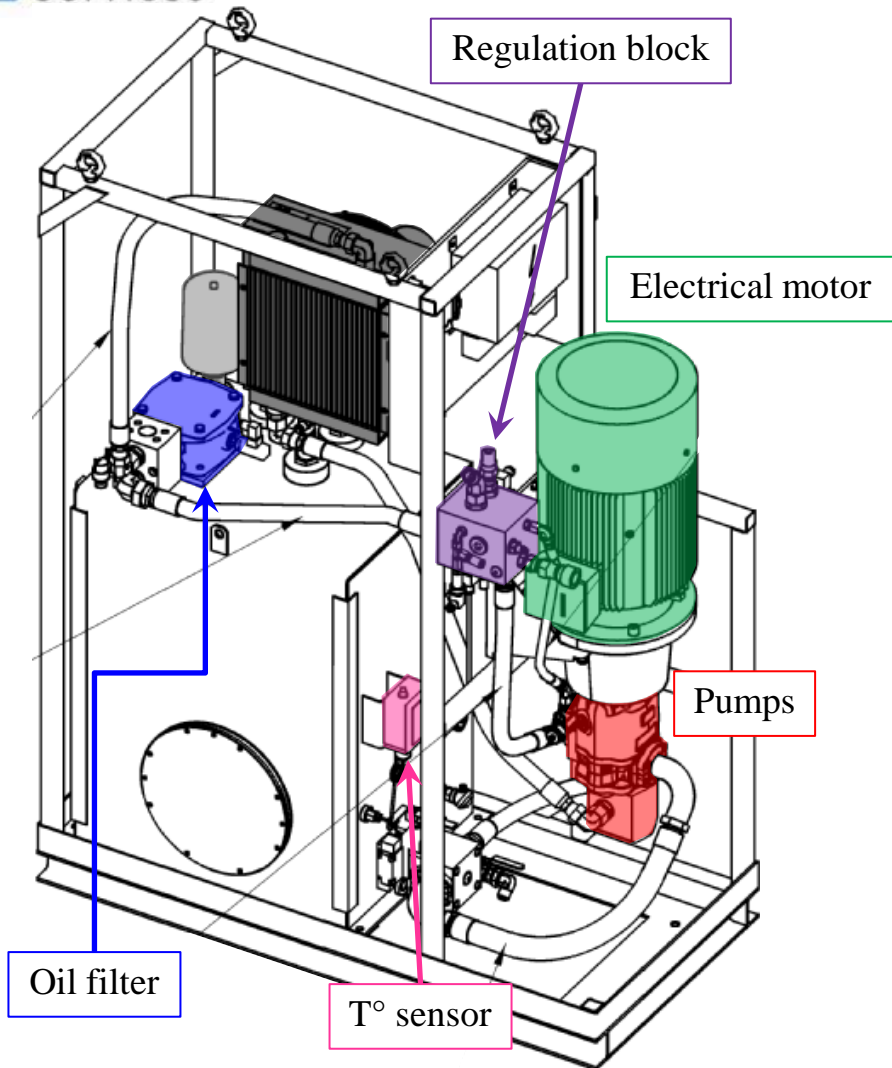
Step 1 = PRESSURE settings:

- The pressure setting value must be adjust as per the data sheet indicated in the maintenance manual.

Step 3 = Calibration:

- Press 'Adjust flow' button on Panel View than press dead man on joystick => The tool will move in automatic to adjust the flow as per encoder value (in m/min).

HYDRAULIC UNIT FRONT VIEW





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EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

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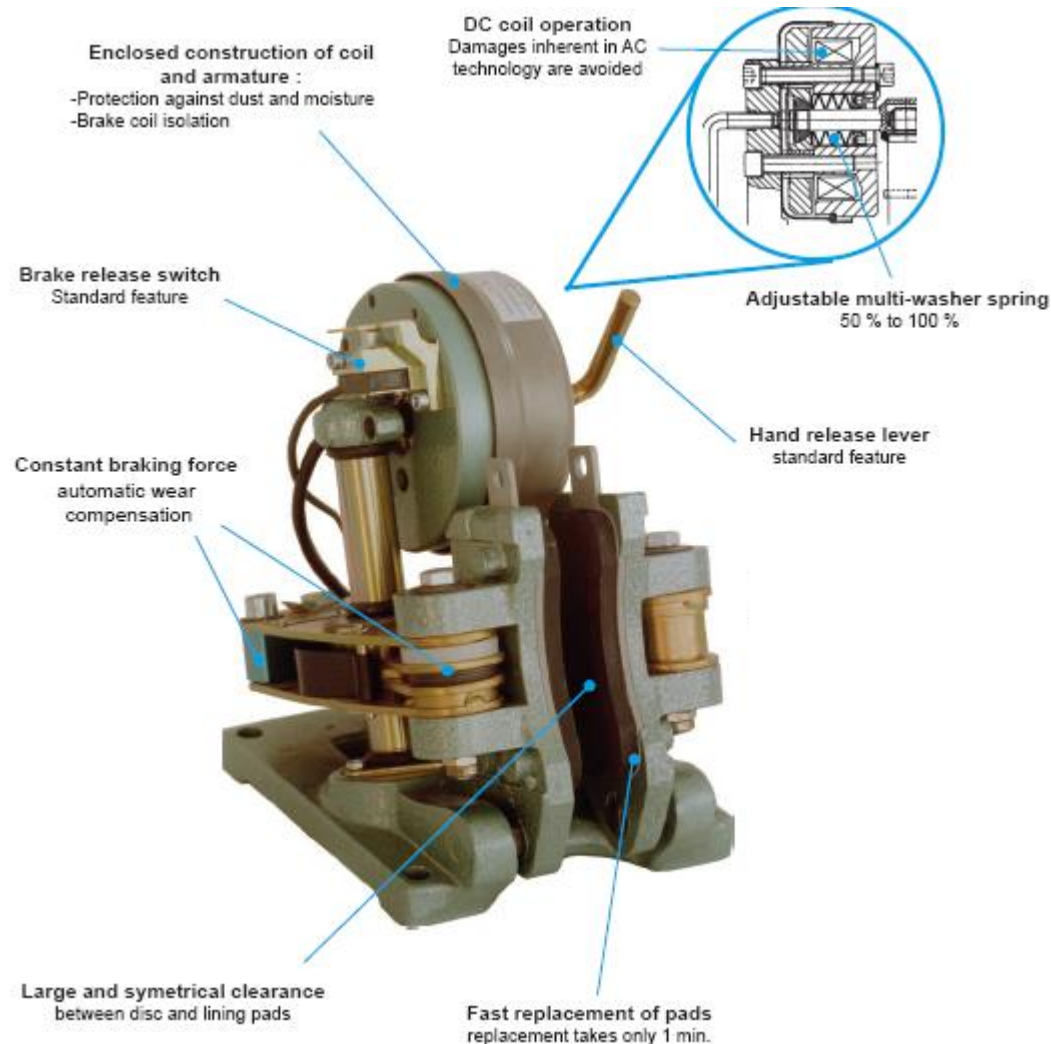
MA'ADEN PROJECT

P1034 - PTM

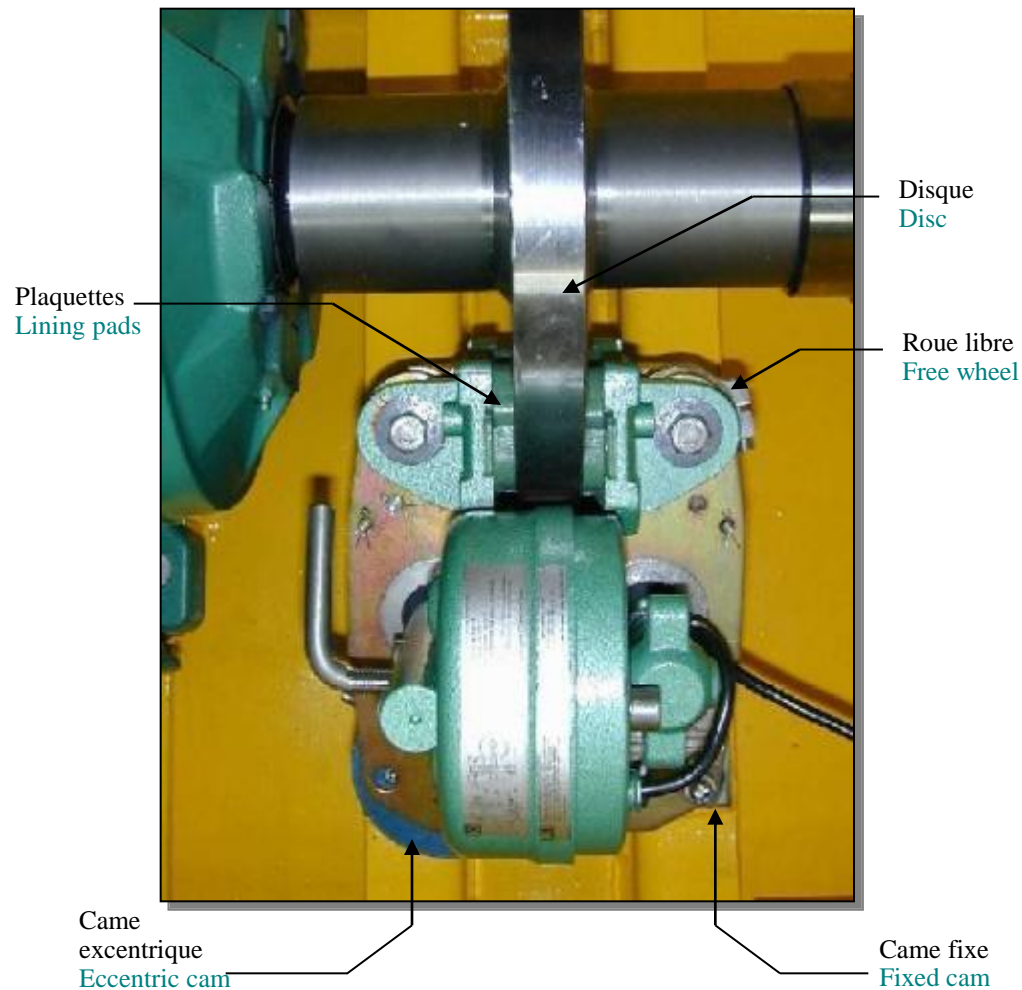
POT TENDING MACHINE

Compensated brake Type 52

VUE REELLE PHOTOGRAPHIC VIEW

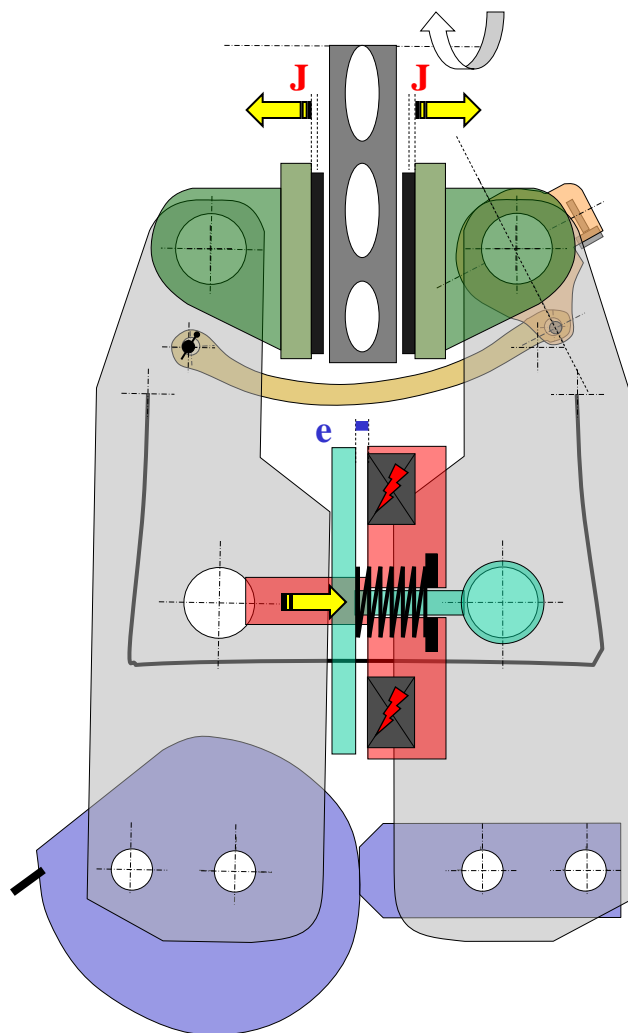


VUE REELLE PHOTOGRAPHIC VIEW



PHASES DE FONCTIONNEMENT

OPERATING STEPS



Redémarrage / Restarting

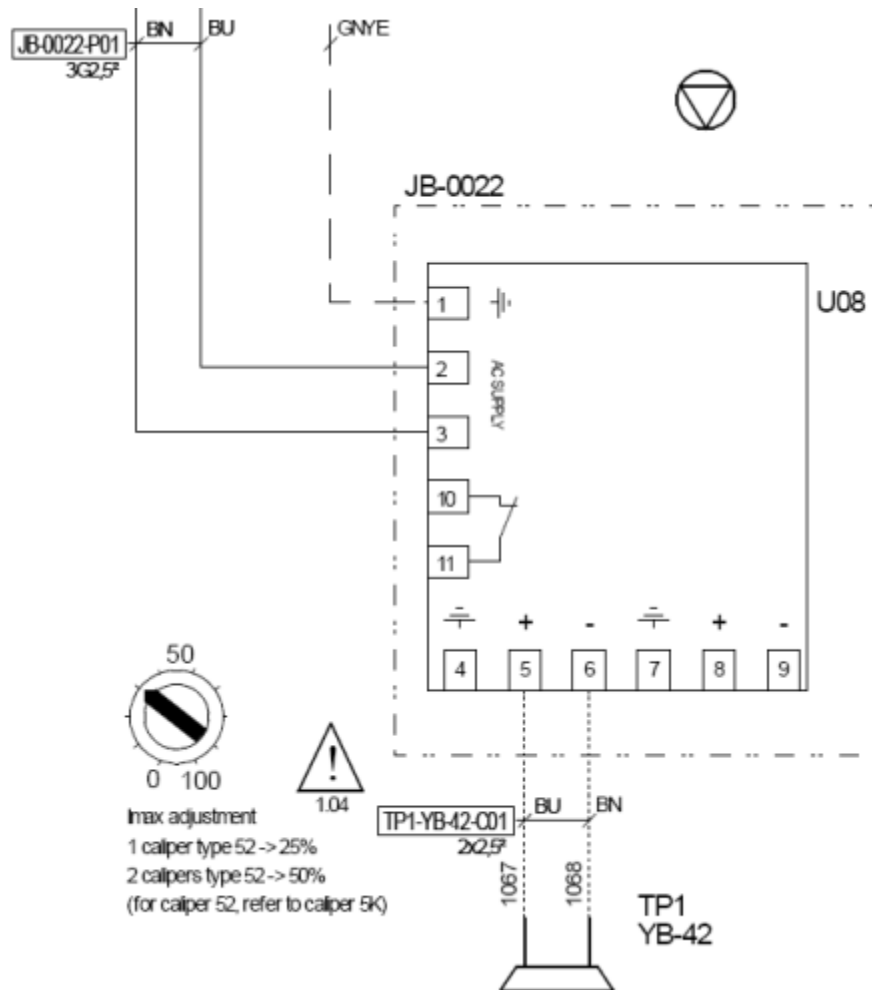
Dégagement des garnitures limité à la valeur **J**
par l'action de la roue libre.

Motor and brake energized
Free wheel limits the opening at the value **J+J**
Its remains an air gap = **e**.

EQUIPMENT AND SERVICES FOR PRIMARY ALUMINIUM SMELTERS WORLDWIDE

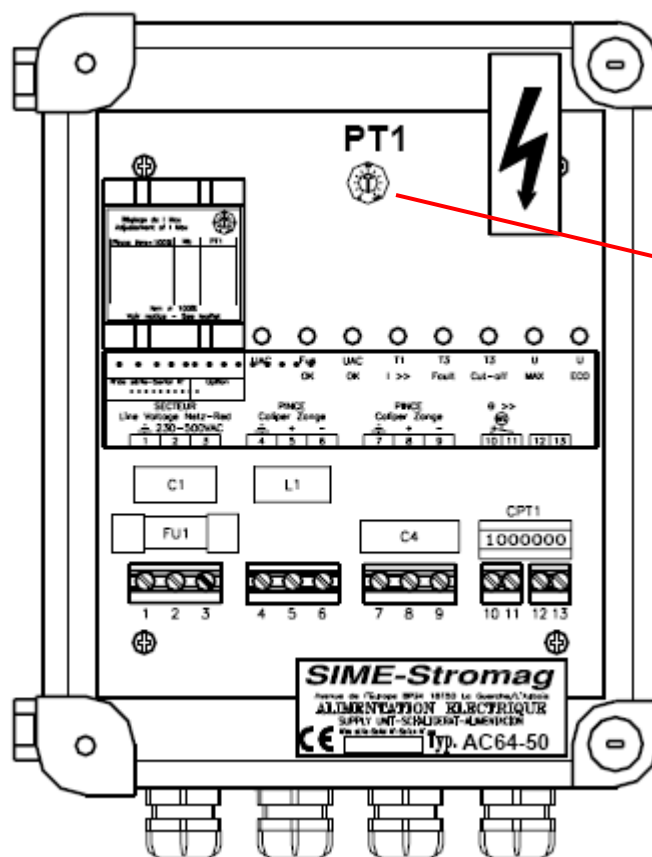
**ALIMENTATION
ELECTRIQUE
ELECTRICAL POWER
SUPPLY**

ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY

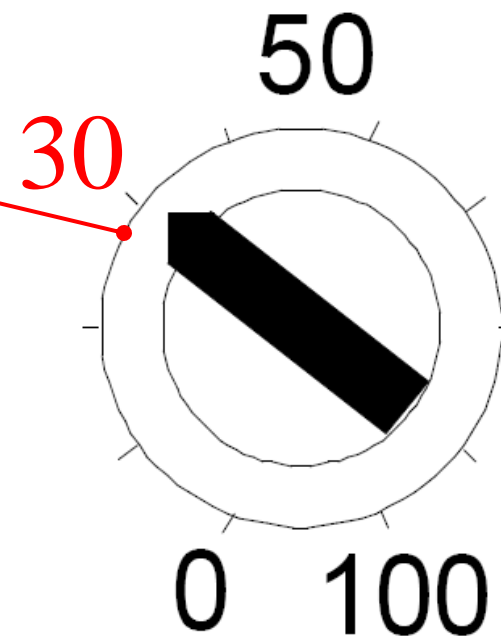


Power supply: AC64-50 CP

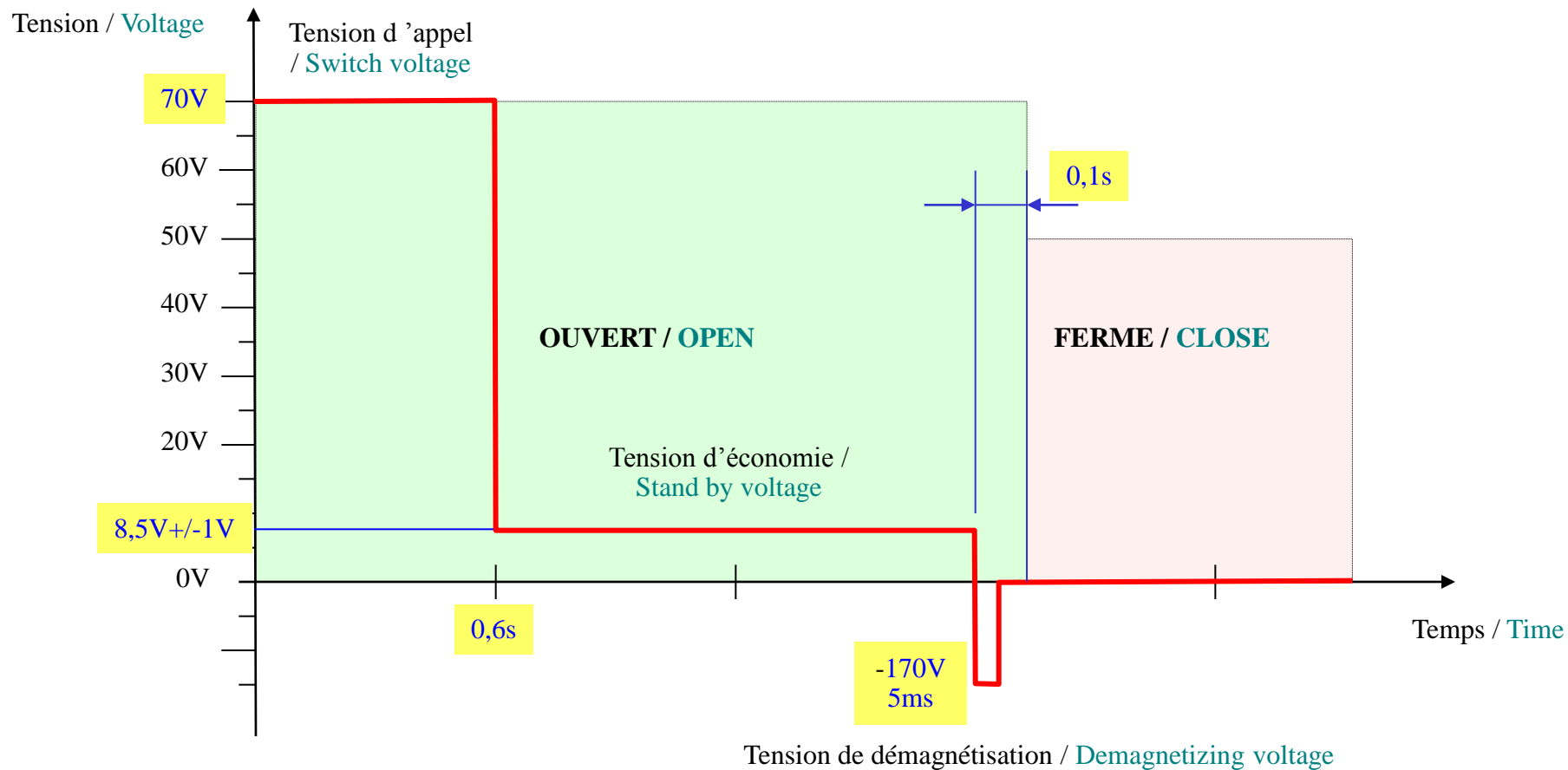
ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



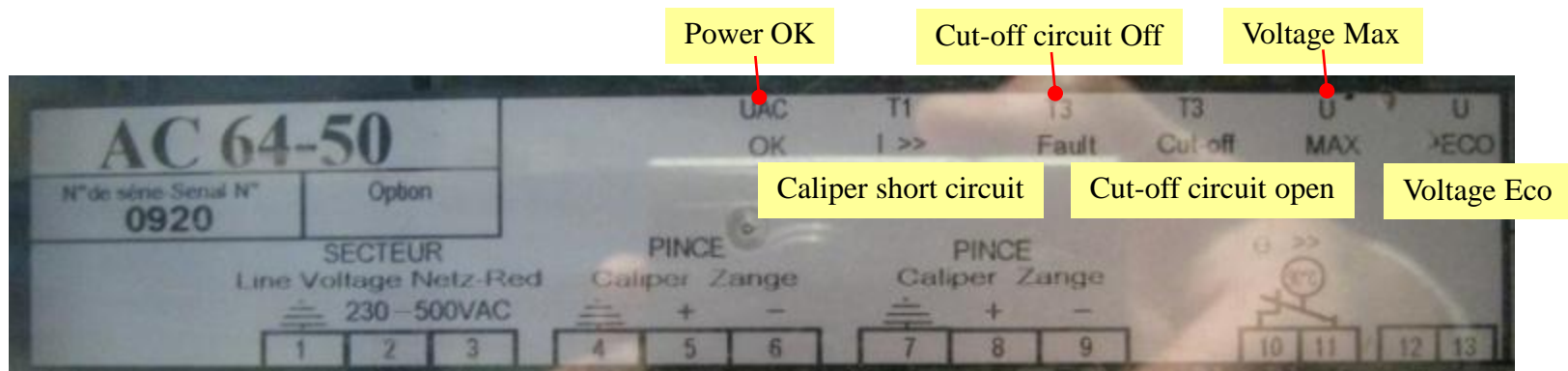
Potentiometer PT1



ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY

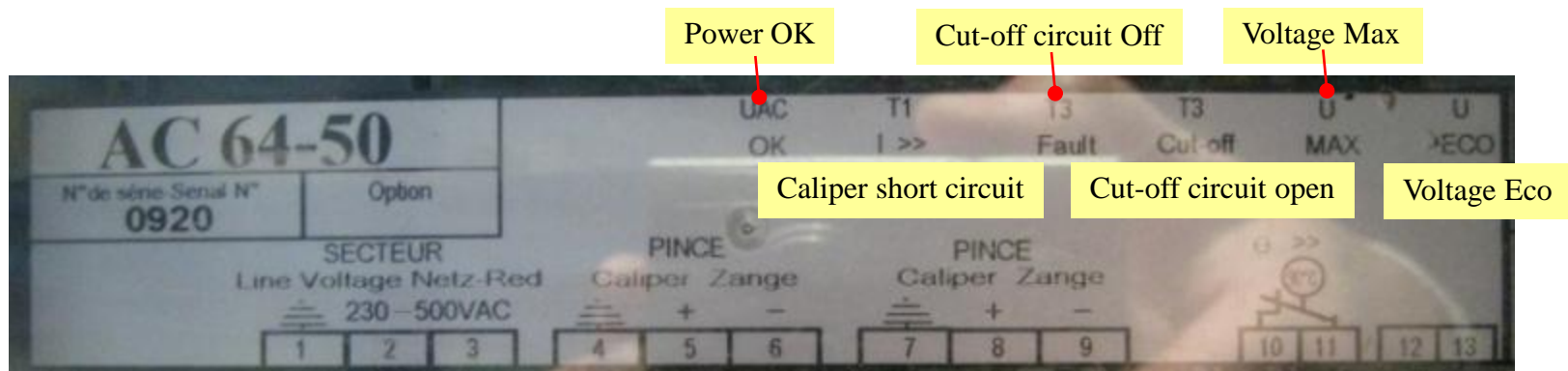


⊗ LED on	○ LED off
⊗ LED on during 20ms	

Lights	Function	Description
UAC	Mains current presence	Green LED on, in the presence of a mains voltage on terminals 2-3
FUS OK	Fuse OK	Green LED on, if fuse is OK
UAC OK	Current mains OK	Green LED on, if the mains voltage is correct on terminals 2-3
T1 I>>	Short circuit caliper	Red LED on, in case of short circuit on caliper output
T3 Fault	Cut-off circuit Fault	Red LED on, if cut-off circuit is on short circuit
T3 Cut-off	Cut-off circuit active	Red LED on, if cut-off circuit is opened
U MAX	Current MAX	Yellow LED on, in the presence of Max current (opening of the brakes)
U ECO	Current ECO	Green LED on, in the presence of economy voltage (keeping up brakes opened)

ALIMENTATION ELECTRIQUE

ELECTRICAL POWER SUPPLY

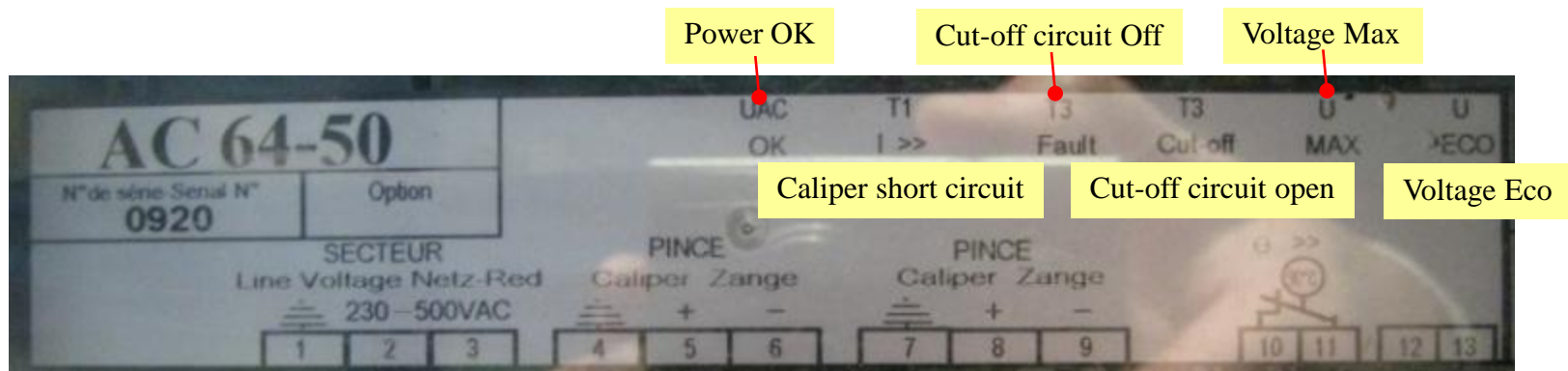


⊗ LED on	○ LED off
⊗ LED on during 20ms	

Normal cycle of brake opening /closing

UAC	FUS OK	UAC OK	T1 I>>	T3 Fault	T3 Cut off	U MAX	U ECO	OPERATING STATE
⊗	⊗	⊗	○	○	⊗ 20ms	○	○	Cut-off current opened during 20ms at energizing
⊗	⊗	⊗	○	○	○	⊗ 0.6s	○	Current Max active for callipers opening (0.6s max)
⊗	⊗	⊗	○	○	○	○	⊗	Current ECO active for keeping up callipers opened
○	○	○	○	○	⊗ 0.5s	○	○	Cut-off circuit opened for the fast closing of callipers (LED on to 0.2 at 1s)

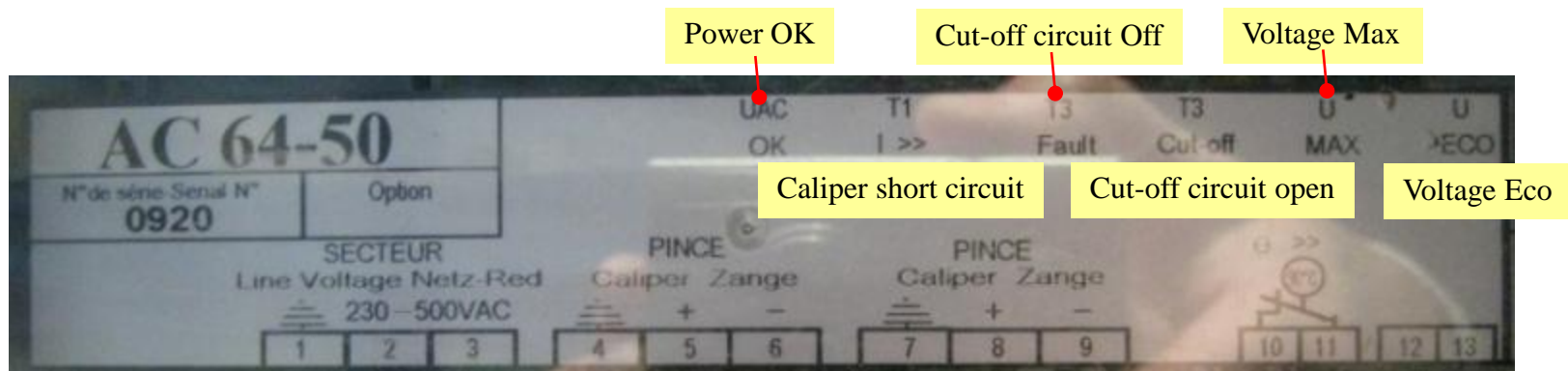
ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



Operating fault

UAC	FUS OK	UAC OK	T1 I >>	T3 Fault	T3 Cut off	U MAX	U ECO	DETECTED FAULT	ACTION
⊗	⊗	○	○	○	⊗	○	○	Mains voltage too low	Check the mains
⊗	⊗	⊗	○	○	○	○	○	Potentiometer PT1 on 0%	Adjust the potentiometer PT1 following the type and number of caliper
⊗	⊗	⊗	⊗	○	○	○	○	Cut-off on caliper output	Check the wiring of the caliper output
⊗	⊗	⊗	○	⊗	○	○	○	Cut-off circuit in short circuit	Return power supply OS at Stromag France
⊗	⊗	⊗	○	○	⊗	○	○	Cut-off circuit crossed	Return power supply OS at Stromag France
⊗	⊗	⊗	○	○	○	⊗	○	- Absence of the caliper - Power supply blocked in voltage MAX	- Check the wiring of the caliper - Return power supply OS at Stromag France
⊗	○	○	○	○	○	○	○	Fuse FU1 OS	Replace the fuse and check the correct operation of power supply

ALIMENTATION ELECTRIQUE ELECTRICAL POWER SUPPLY



Operating fault of the brake

Detected faults	Check
No caliper opening when energizing	The PT1 setting - The caliper air gap - The MAX voltage- The wiring of opening switch-The mains presence
Closing of the caliper during economy voltage	The ECO voltage- The wiring of opening switch -The mains control- The possible fouling of caliper air gap
Slow closing of the caliper	The caliper voltage at mains cut-off - The setting of caliper torque - Mains control - power supply type (R option)



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